## Chapter 1 On 35 Approaches for Distributed MPC Made Easy

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**Abstract** In this chapter the motivation for developing a comprehensive overview of distributed MPC techniques such as presented in this book is discussed. Understanding the wide range of techniques available becomes easier when a common structure and notation is adopted. Therefore, a list of questions is proposed that can be used to obtain a structured way in which such techniques can be described, and a preferred notation is suggested. This chapter concludes with an extensive categorization of the techniques described in this book, and compact representations of the properties of each individual technique. As such, this chapter serves as a starting point for further developing understanding of the various particularities of the different techniques.

#### **1.1 Introduction**

### 1.1.1 From Centralized to Distributed Control

The evolution of computer science and information technology has made possible the application of control techniques to systems that were beyond the possibilities of control theory just a decade ago. The size of the problems faced today by control engineers has grown enormously as the limitations imposed by the communication and computational capabilities decrease. In this sense, there are strong incentives to be ambitious: society heavily depends on infrastructure systems, such as road-traffic networks, water networks, electricity networks, intermodal transport networks, etc.

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These are examples of large-scale, networked systems, that everybody makes use of on a daily basis, and any performance improvement would have a great direct impact on the society. However, traditional centralized control approaches cannot be used with these kind of systems due to, e.g., centralized computational issues or issues with centralized modeling, data collection and actuation.

It is at this point where distributed controllers come into play. The idea behind distributed control approaches is simple: the centralized problem is divided in several different parts whose control is assigned to a certain number of local controllers or *agents*. Therefore, each agent does not have a global vision of the problem. Depending on the degree of interaction that exists between the local subsystems, the agents may need to communicate so that they can coordinate themselves.

Distributed approaches have important advantages that justify their use. The first advantage is that in general these schemes are easier to implement. Their computational requirements are lower because a difficult problem is substituted by several smaller problems. In addition, these schemes are scalable. Their inherent modularity simplifies the system maintenance and the possible expansions of the control system. Moreover, the modularity provides robustness in comparison with a centralized controller. A possible failure does not have to affect the overall system. For this reason, distributed systems have a greater tolerance to failures. Nevertheless, these systems have also several drawbacks that have to be taken into account, being the main one the loss of performance in comparison with a centralized controller. This loss depends on the degree of interaction between the local subsystems and the coordination mechanisms between the agents.

During the last years many distributed control approaches using the control strategy model predictive control (MPC) have been proposed. MPC is a popular control strategy for the design of high performance model-based process control systems because of its ability to handle multi-variable interactions, constraints on control (manipulated) inputs and system states, and optimization requirements in a systematic manner. These features are essential in this context because they allow the control engineer to handle explicitly the interactions between the different subsystems.

#### 1.1.2 Need for an Overview

Although many approaches for distributed MPC have been proposed, a coherent and easily accessible overview of the components of these approaches is lacking. Having such an overview would facilitate making the approaches easier known to a wider community, and help students, researchers and practitioners in choosing the approach most suitable for their particular situation.

This book is the result of the efforts of creating such an overview. For researchers and students, the book can provide a state-of-the-art overview, while at the same time making clear directions of research that deserve more attention. The goal that was kept in mind while developing the book was to make available to a wide audience in a systematic, practical, and accessible way the available approaches for distributed (and hierarchical) MPC. To make this possible, in each chapter of the book one particular approach is described, including:

- 1. the rationale and background of the approach;
- 2. the assumptions made on the system dynamics, control objectives and constraints;
- 3. a step-by-step description of the computations/equations;
- 4. the availability of theoretical results;
- 5. the availability of real (or simulated) applications.

The consistent description of all approaches enables readers to compare the approaches and assess the usefulness of these approaches for their respective applications.

This remainder of this chapter is structured as follows. In Sect. 1.2 we present the list of questions that served as basis for structuring the descriptions of the various schemes and the notation suggested to be used is presented. In Sect. 1.3, specific properties of distributed MPC schemes are described and a naming convention for distributed MPC schemes is proposed. Section 1.4 provides concluding remarks. Finally, Sect. 1.4 gives a categorization of schemes according to values of the properties and summaries of the specific values of a property per scheme.

#### **1.2 Distributed MPC Schemes Commonalities**

In order to obtain coherence in the description of distributed MPC schemes, we propose to structure the description of a scheme using a pre-specified set of questions and a common notation. These questions and notation suggestions were also used in the preparation of the schemes described in this book.

#### **1.2.1 Description Questions**

The most important and distinguishing elements of each distributed MPC scheme are captured by describing a scheme along the following line:

- 1. Short introduction
  - What is the rationale behind the approach?
  - Where did it originate from?
  - What makes this approach interesting?
- 2. Boundary conditions on considered system, control objectives, and constraints
  - What kind of system partition and type of dynamical model is assumed?
  - What kind of control problem is being solved for this kind of system?
  - What kind of communication architecture is assumed available?

- 3. Step-by-step description of how the approach works
  - What initialization is required?
  - What equation/optimization is used when?
  - When does what communication take place with which agent?
  - When do agents agree on/decide to take an action?
- 4. Availability of theoretical results
  - What theoretical properties have been investigated?
  - How does the approach relate to other existing approaches?
  - Where have results of this been published?
- 5. Availability of actual applications of the approach
  - What are the systems in which your approach has been tested?
  - Where have results of this been published?

#### 1.2.2 Consistent Notation

Considering a common notation increases the coherence among the chapters and facilitates comparing the various techniques discussed. The following notational guidelines are suggested:

- Number types:
  - $-\mathbb{R}$  for real numbers.
  - $-\mathbb{Z}$  for integers.
- Vectors:
  - Boldface and small characters, e.g., x.
  - $-n_{\rm x}$  for dimension of a vector **x**.
  - $\mathbf{x}(k+1:k+N_p)$  represents  $[\mathbf{x}^{\mathrm{T}}(k+1), \ldots, \mathbf{x}^{\mathrm{T}}(k+N_p)]^{\mathrm{T}}$ .
- Matrices: Boldface and capital characters, e.g., A, B.
- Sets: Calligraphic characters, e.g.,  $\mathcal{N}$ .
- Model description:
  - x for states
  - u for inputs/actions
  - y for outputs/measurements
  - d for disturbances.
- Functions:
  - -f, g, h for functions returning scalars; boldface versions for functions returning a column vector.
  - $\oplus$  for Minkowski sum, i.e.,  $\mathcal{A} \oplus \mathcal{B} \triangleq \{a + b : a \in \mathcal{A}, b \in \mathcal{B}\}.$
  - $-\sim$  for the Pontryagin difference, i.e.,  $\mathcal{A} \sim \mathcal{B} \triangleq \{a : a + b \in \mathcal{A}, \forall b \in \mathcal{B}\}.$

- Subsystems:
  - $\mathcal{N}$  for the set of subsystems.
  - $-|\mathcal{N}|$  for the cardinality of  $\mathcal{N}$ , i.e., the number of subsystems.
  - Subscript *i* for a variable of subsystem *i*, e.g.,  $\mathbf{x}_i$ .
  - Subscript j for a variable of another subsystem (e.g., neighboring), e.g.,  $\mathbf{x}_j$ .
- Network: Graph (N, E), where N is the set of subsystems and E ⊂ N × N is the set of edges/links.
- Time:
  - Discrete time index k.
  - Continuous time t.
  - Time index as parameter of variable: in brackets behind a variable, e.g.,  $\mathbf{x}(k)$ .
- Model predictive controller:
  - Performance index: J.
  - Penalty matrices: **Q** for the state, **R** for the actuation.
  - Target/references values for x: x<sub>ref</sub>.
  - Target/references values for subsystem  $i: \mathbf{x}_{ref,i}$ .
  - Prediction horizon length:  $N_{\rm p}$ .
  - Control horizon length:  $N_c$ .
  - Time step within prediction horizon: *l*.
  - The value of a variable x at iteration p will be denoted using a superscript:  $x^p$ .
- Math:
  - Transpose: Superscript T, e.g., **x**<sup>T</sup>.
  - Min/max: Subscripts min and max of a variable, e.g.,  $x_{min}$  and  $x_{max}$ , represent the minimum and maximum value of that variable, respectively.
  - $\|\mathbf{z}\|_{\mathbf{M}}$  is the weighted Euclidean norm, i.e.,  $\sqrt{\mathbf{z}^{T}\mathbf{M}\mathbf{z}}$

#### **1.3 Properties for Categorization**

There exist many different features that can be used to described a distributed control scheme. We consider the following main sets of properties as basis for comparison: process properties, control architecture properties, and theoretical properties.

#### **1.3.1** Process Properties

This set of properties is related with the specifications of the physical system that is going to be controlled using a distributed scheme. This is an important point since it determines what schemes can be used to control the system. The most important process features are:

- **System type**, or the way in which the scheme is derived: either starting from a group of autonomous systems and then introducing communication to obtain coordination, or from a (hypothetical) monolithic system decomposed into subsystems that are coordinated taking into account limitations in communication/processing power. This book itself has been partitioned in two parts according to this feature.
- **Process type**, or the kind of dynamics that better capture the behavior of the system: linear, non-linear, or hybrid.
- **Type of model**, or the way in which the system model is described mathematically: transfer function or state-space.
- **Randomness**, i.e., whether the process shows a deterministic or non-deterministic behavior.
- Type of control, i.e., the control goal: regulation, tracking, or economic.
- **Coupling source**, or whatever makes the overall optimization problem become non-separable: inputs, outputs, state, objective, or constraints. Notice that some schemes may deal with more than one coupling source and consequently they appear in more than one column.

We present a classification of the schemes contained in the book according to this feature in Table 1.1. Table 1.2 shows a classification of the schemes in the book according to this feature. The classification of schemes according to the type of model is presented in Table 1.3. Table 1.4 presents a classification of the schemes according to the randomness feature. Table 1.5 shows a classification of the schemes in the book according to the type of control. In Table 1.6 we present the schemes that deal with each of the five possible coupling sources.

#### **1.3.2** Control Architecture Properties

This set of properties describe the essence of the schemes presented in the book. These features are important from a practical point of view, as there may be real situations in which a scheme cannot be applied due to, for example, communicational or informational constraints. The most important features are:

• Architecture, or how the coordination between local controllers is structured: decentralized, distributed, and hierarchical. In general, the controllers can be classified depending on how many of them participate in the solution of the control problem and the relative importance between them. We say that a control system is centralized if there is a single controller that solves the plant-wide problem. The control is decentralized when there are local controllers in charge of the local subsystems of the plant that require no communication among them. When the local controllers communicate in order to find a cooperative solution for the overall control layers coordinated to take care of the process the control system is hierarchical. In this case, upper layers manage the global objectives of the plant.

- **Controller knowledge**, which measures the degree of global information that a a controller has: strictly local or partially global. Naturally, the amount of information that each agent has about the overall system has a great impact in the performance and ease of implementation of the scheme.
- **Computation type**, or how the joint control actions are calculated, in an iterative or non-iterative fashion.
- **Controller's attitude**, i.e., the degree in which an agent takes into account other agents' objectives: non-cooperative, or cooperative. In general, attitude is related with the will of collaboration between subsystems. We say that a controller has a noncooperative attitude if it behaves selfishly, i.e., it only seeks the maximization of its own objective function. On the other hand, the controllers's attitude is cooperative when the it minimizes not only its cost but the cost of its neighbors. Hence, it may make sacrifices in terms of its own welfare to help the overall system attain a better global situation. Notice that there are some schemes that are really in between these two categories as their local controllers have both cooperative and noncooperative features. In this case, we have approximated the controller to the category in which it fits better.
- **Communication**, or if there is a sequence in which the agents transmit and receive information: serial and parallel. In particular, under the serial communication paradigm only one controller can communicate at the same time in contrast with parallel communication, where several controllers are allowed to communicate at the same time.
- **Timing**, or whether there is or not a strict schedule in the communication process that determines when controllers can communicate: synchronous or asynchronous.
- **Optimization variables**, i.e., the nature of the variables in the optimization problem: real or integer. Notice that some schemes are in both columns since they use both these type of variables, i.e., they solve a mixed-integer optimization problem.

The classification of schemes according to this feature is presented in Table 1.7. The classification of schemes according to the controller knowledge is shown in Table 1.8. Table 1.9 shows the classification of schemes according to the computation type. Table 1.10 presents a classification of the schemes contained in the book according to the controller's attitude. In Table 1.11 we present the classification of the schemes according to the communication. A classification of the chapters of the book according to timing can be seen in Table 1.12. Table 1.13 presents the schemes that use each type of optimization variable.

#### **1.3.3 Theoretical Properties**

This set of properties has to do with the availability of mathematical results that provide a certain guarantee regarding the scheme's performance. The following set of properties have been considered:

- **Optimality**, i.e., if the scheme provides the same result that the corresponding centralized optimization problem.
- **Suboptimality bounds**, i.e., if the scheme provides a measurement of the distance with respect to the optimum of the corresponding centralized optimization problem.
- **Stability**, i.e., if the scheme guarantees a non-divergent evolution of the state and the output of the system.
- Robustness, if the scheme is able to reject external unknown disturbances.

Table 1.14 shows a classification of the schemes according to optimality. A classification of the schemes of the book according to the suboptimality bounds property is presented in Table 1.15. Table 1.16 shows a classification of the schemes according to the stability property. We present a classification of the schemes according to the robustness property in Table 1.17.

#### 1.3.4 Naming Convention

Using the values of the properties of the distributed MPC schemes, we propose a naming convention, to able to refer to different schemes in a standardized way. The short name that we propose is derived from three of the aforementioned features, the key features that are used to structure the distributed MPC schemes in this book. In particular, each short name is composed of:

- Two letters indicating if the scheme is tailored for monolithical systems (Mo) or multiple independent systems (Ma).
- Two or three letters indicating if the local controllers use a sensible amount of global information (Glo) or mainly local information (Lo).
- Two or three letters indicating whether the scheme is iterative (It) or not (Nit).
- A slash, followed by the first letters of the first author of the chapter.

This short naming convention provides the essence of each scheme at a glance. Naturally, there may be other short naming options. We propose this way for the following reasons.

- We consider the main property the *System type* feature. Undoubtedly, this is the most important feature since it has to do with the perspective from which the distributed control scheme has been designed, bottom-up or top-down. Likewise, there is also a sensitive difference in the target applications of these two families of schemes. We observe two different perspectives: *The Group of Autonomous Systems Perspective* and *The Decomposed Monolithic System Perspective*.
- The second property has to do with the degree of global information that local controllers have. On the one have we have local controllers that only have strict local information and on the other we have controllers with a significant amount of global information. While the first approach could be favorable for systems with

a dynamic structure (e.g. plug-and-play networks), the second can simplify the coordination due to the additional knowledge about the overall system.

• Finally, we have chosen as third distinguishing property in the short naming the *Computation type*, i.e., if the scheme is iterative or not.

This book is structured using the same criteria on which the short naming convention is based. The chapters in the book are ordered from most distributed to most centralized, as shown in Table 1.1. Indeed, the first chapter discussed scheme MaLoNit, i.e., multiple subsystems controlled by agents that only have local knowledge and that do not iterate in order to find a solution. This contrasts the last chapter of the book, which is MoGloIte, i.e, a scheme considering local controllers that have global system information and exchange information iteratively in order to find a control action for the decomposed monolithical system they are controlling.

#### **1.4 Concluding Remarks**

The techniques presented in the book, introduced in accessible and standardized way, constitute a true handbook of distributed model predictive control. In this sense, we believe that this book will become a valuable aid for those readers that are beginning their research careers (e.g.: master and PhD students). Likewise, researchers in the field will find in this book a valuable survey of the state-of-the-art methods carefully explained by their original contributors. But the contribution of the book goes far beyond theory. The current compilation of hierarchical, decentralized and specially distributed model predictive control schemes provides a potential solution to almost any imaginable application. Vehicle formation, irrigation canals, chemical processes, energy networks, among many others, are used as benchmarks in the book. For this reason, practitioners will also find the tools and *recipes* they need to face their practical challenges.

As editors of this compilation of schemes, we do not expect this first edition of the book to be the last one. Despite that the field of distributed MPC has registered a strong research activity during the last decade, there are still new schemes being proposed every now and then. On top of that, it is also easy to find enhancements of previous schemes that guarantee new theoretical properties. Nevertheless, we can say the basis of this young research field is already settled.

What will the future bring? We envision several potential research lines. We expect a refinement of the most popular schemes aiming to a commercial implementation. So far, most distributed control schemes have only been tested via simulations or with lab benchmarks. A real implementation will demand to discard some of the simplifications made during the research, e.g. common distributed computing fallacies as assuming that the network is reliable. We also expect a proliferation of dynamic distributed control schemes, able to adapt the degree of coordination to the circumstances. For example, one may think of a traffic network. When the system is close to congestion, a high degree of coordination and communication is necessary between the agents. On the contrary, if the roads are almost empty (e.g., at night), such coordination is not needed and agents can work in a decentralized fashion. Furthermore, the development of the field will also be linked to the evolution of paradigms that may become strong research topics such as the domain of systems of systems.

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#### **Appendix: Comparing the Approaches**

Below follows in Tables 1.1–1.17 per property a categorization per value of the described schemes. After this follows per scheme a summary of the particular values of a property of that scheme. The short names of the distributed MPC schemes falling in particular categories are mentioned, as well as references to the related chapters.

 Table 1.1
 Scheme classification with respect to the system type

System type			
Multiple autonomous systems		Decomposed monolithical system	1
MaLoNit-Val (Chap. 2; [34])	MaLoNit-Tro (Chap. 3; [33])		
MaLoNit-Mar (Chap. 4; [22])	MaLoNit-Mul (Chap. 5; [24])	MoLoIt-Jur (Chap. 22; [1])	MoLoIt-Axe(Chap. 23; [2])
MaLoIt-Bou (Chap. 6; [5])	MaLoIt-Far (Chap. 7; [9])	MoLoIt-Doa (Chap. 24; [8])	MoLoNit-Mae (Chap. 25; [21])
MaLoIt-Lem (Chap. 8; [18])	MaLoIt-Lam (Chap. 9; [17])	MoLoNit-Bet (Chap. 26; [3])	MoLoIt-Neg (Chap. 27; [27])
MaLoIt-Nec (Chap. 10; [26])	MaLoIt-Bie (Chap. 11; [4])	MoLoIt-Zaf (Chap. 28; [35])	MoLoIt-MaeMun (Chap. 29; [20])
MaLoIt-Cam (Chap. 12; [6])	MaGloNit-Hu (Chap. 13; [15])	MoLoIt-Liu (Chap. 30; [19])	MoGloNit-Oca (Chap. 31; [28])
MaGloNit-Her (Chap. 14; [14])	MaGloNit-Ted (Chap. 15; [32])	MoGloNit-Mor (Chap. 32; [23])	MoGloNit-Nab (Chap. 33; [25])
MaGloNit-Cas (Chap. 16; [7])	MaGloIt-Pro (Chap. 17; [30])	MoGloIt-Pan (Chap. 34; [29])	MoGloIt-Fer (Chap. 35; [11])
MaGloIt-Gra (Chap. 18; [13])	MaGloIt-Gis (Chap. 19; [12])	MoGloIt-Fer2 (Chap. 36; [10])	
MaGloIt-Koz (Chap. 20; [16])	MaGloIt-Ros (Chap. 21; [31])		

 Table 1.2
 Scheme classification with respect to the process dynamics

Process type		
Linear	Nonlinear	Hybrid
MaLoNit-Val (Chap. 2; [34])		
MaLoNit-Tro (Chap. 3; [33])		
MaLoIt-Bou (Chap. 6; [5])		
MaLoIt-Lem (Chap. 8; [18])		
MaLoIt-Nec (Chap. 10; [26])		
MaLoIt-Bie (Chap. 11; [4])		
MaLoIt-Cam (Chap. 12; [6])		
MaGloNit-Her (Chap. 14; [14])		

(continued)

Table 1.2	(continued)

Process type		
Linear	Nonlinear	Hybrid
MaGloNit-Ted (Chap. 15; [32])		
MaGloNit-Cas (Chap. 16; [7])	MaLoNit-Mar (Chap. 4; [22])	
MaGloIt-Pro (Chap. 17; [30])	MaLoNit-Mul (Chap. 5; [24])	
MaGloIt-Gis (Chap. 19; [12])	MaLoIt-Far (Chap. 7; [9])	
MaGloIt-Ros (Chap. 21; [31])	MaLoIt-Lam (Chap. 9; [17])	MoLoIt-Axe (Chap. 23; [2])
MoLoIt-Jur (Chap. 22; [1])	MaGloNit-Hu (Chap. 13; [15])	
MoLoIt-Doa (Chap. 24; [8])	MaGloIt-Gra (Chap. 18; [13])	
MoLoNit-Mae (Chap. 25; [21])	MaGloIt-Koz (Chap. 20; [16])	
MoLoNit-Bet (Chap. 26; [3])	MoLoIt-Liu (Chap. 30; [19])	
MoLoIt-Neg (Chap. 27; [27])		
MoLoIt-Zaf (Chap. 28; [35])		
MoLoIt-Mae2 (Chap. 29; [20])		
MoGloNit-Oca (Chap. 31; [28])		
MoGloNit-Mor (Chap. 32; [23])		
MoGloNit-Nab (Chap. 33; [25])		
MoGloIt-Pan (Chap. 34; [29])		
MoGloIt-Fer (Chap. 35; [11])		
MoGloIt-Fer2 (Chap. 36; [10])		

Table 1.3         Scheme classification with respect to the type of model used
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Type of model			
Transfer function	State space		
	MaLoNit-Val (Chap. 2; [34])	MaLoNit-Tro (Chap. 3; [33])	
	MaLoNit-Mar (Chap. 4; [22])	MaLoNit-Mul (Chap. 5; [24])	
	MaLoIt-Bou (Chap. 6; [5])	MaLoIt-Far (Chap. 7; [9])	
	MaLoIt-Lem (Chap. 8; [18])	MaLoIt-Lam (Chap. 9; [17])	
	MaLoIt-Nec (Chap. 10; [26])	MaLoIt-Bie (Chap. 11; [4])	
	MaLoIt-Cam (Chap. 12; [6])	MaGloNit-Hu (Chap. 13; [15])	
	MaGloNit-Her (Chap. 14; [14])	MaGloNit-Ted (Chap. 15; [32])	
MoGloIt-Pan (Chap. 34; [29])	MaGloNit-Cas (Chap. 16; [7])	MaGloIt-Pro (Chap. 17; [30])	
	MaGloIt-Gra (Chap. 18; [13])	MaGloIt-Gis (Chap. 19; [12])	
	MaGloIt-Koz (Chap. 20; [16])	MaGloIt-Ros (Chap. 21; [31])	
	MoLoIt-Jur (Chap. 22; [1])	MoLoIt-Axe (Chap. 23; [2])	
	MoLoIt-Doa (Chap. 24; [8])	MoLoNit-Mae (Chap. 25; [21])	
	MoLoNit-Bet (Chap. 26; [3])	MoLoIt-Neg (Chap. 27; [27])	
	MoLoIt-Zaf (Chap. 28; [35])	MoLoIt-Mae2 (Chap. 29; [20])	
	MoLoIt-Liu (Chap. 30; [19])	MoGloNit-Oca (Chap. 31; [28])	
	MoGloNit-Mor (Chap. 32; [23])	MoGloNit-Nab (Chap. 33; [25])	
	MoGloIt-Fer (Chap. 35; [11])	MoGloIt-Fer2 (Chap. 36; [10])	

Randomness Deterministic		Non-deterministic	
MaLoNit-Val (Chap. 2; [34]) MaLoNit-Mul (Chap. 5; [24]) MaLoli-Lem (Chap. 8; [18]) MaLoli-Lem (Chap. 8; [18]) MaLoli-Nec (Chap. 10; [26]) MaGloNit-Can (Chap. 12; [6]) MaGloNit-Cas (Chap. 16; [7]) MaGloNit-Cas (Chap. 16; [7]) MaGloIt-Gis (Chap. 19; [12]) MaGloIt-Gis (Chap. 19; [12]) MoLolit-Doa (Chap. 21; [31]) MoLolit-Baet (Chap. 26; [3]) MoLoNit-Baet (Chap. 26; [3]) MoGloIt-Mae2 (Chap. 31; [28]) MoGloNit-Nab (Chap. 33; [25])	MaLoNit-Mar (Chap. 4; [22]) MaLoIt-Bou (Chap. 6; [5]) MaLoIt-Lam (Chap. 9; [17]) MaLoIt-Bie (Chap. 11; [4]) MaGloNit-Hu (Chap. 13; [15]) MaGloIt-Gra (Chap. 13; [32]) MaGloIt-Gra (Chap. 18; [13]) MaGloIt-Koz (Chap. 20; [16]) MoLoIt-Axe (Chap. 23; [2]) MoLoNit-Mae (Chap. 25; [21]) MoLoIt-Neg (Chap. 27; [27]) MoLoIt-Liu (Chap. 32; [23]) MoGloNit-Mor (Chap. 32; [23]) MoGloIt-Fer2 (Chap. 36; [10])	Non-deterministic MaLoNit-Tro (Chap. 3; [33]) MaGloIt-Pro (Chap. 17; [30]) MoLoIt-Zaf (Chap. 28; [35])	MaLoIt-Far (Chap. 7; [9]) MoLoIt-Jur (Chap. 22; [1])

 Table 1.4
 Scheme classification with respect to the randomness of the process

 Table 1.5
 Scheme classification with respect to the objective of type of control that the operation of the process demands

Type of Control		
Regulation	Tracking	Economic
MaLoNit-Tro(Chap. 3; [33])		
MaLoNit-Mul (Chap. 5; [24])		
MaLoIt-Far (Chap. 7; [9])		
MaLoIt-Nec (Chap. 10; [26])	MaLoNit-Val (Chap. 2; [34])	
MaLoIt-Cam (Chap. 12; [6])	MaLoNit-Mar (Chap. 4; [22])	
MaGloNit-Hu (Chap. 13; [15])	MaLoIt-Bou (Chap. 6; [5])	MaLoNit-Val (Chap. 2; [34])
MaGloNit-Her (Chap. 14; [14])	MaLoIt-Lem (Chap. 8; [18])	MaLoIt-Bou (Chap. 6; [5])
MaGloIt-Pro (Chap. 17; [30])	MaGloNit-Ted (Chap. 15; [32])	MaLoIt-Lam (Chap. 9; [17])
MaGloIt-Gra (Chap. 18; [13])	MaGloNit-Cas (Chap. 16; [7])	MaLoIt-Bie (Chap. 11; [4])
MaGloIt-Gis (Chap. 19; [12])	MaGloIt-Ros (Chap. 21; [31])	MaGloIt-Koz (Chap. 20; [16])
MoLoIt-Jur (Chap. 22; [1])	MoLoIt-Axe (Chap. 23; [2])	MoLoIt-Neg (Chap. 27; [27])
MoLoIt-Doa (Chap. 24; [8])	MoLoIt-Neg (Chap. 27; [27])	MoGloNit-Oca (Chap. 31; [28]
MoLoNit-Mae (Chap. 25; [21])	MoGloNit-Nab (Chap. 33; [25])	
MoLoNit-Bet (Chap. 26; [3])	MoGloIt-Pan (Chap. 34; [29])	
MoLoIt-Neg (Chap. 27; [27])	MoGloIt-Fer (Chap. 35; [11])	
MoLoIt-Zaf (Chap. 28; [35])		
MoLoIt-Mae2 (Chap. 29; [20])		
MoLoIt-Liu (Chap. 30; [19])		
MoGloNit-Mor (Chap. 32; [23])		
MoGloIt-Fer2 (Chap. 36; [10])		

Constraints		Objective		
MaLoNit-Val (Chap. 2; [34])	MaLoNit-Tro (Chap.	3; [33])		
MaLoNit-Mar (Chap. 4; [22])	MaLoNit-Mul (Chap	. 5; [24])		
MaLoIt-Bou (Chap. 6; [5])	MaLoIt-Lam (Chap.	9; [17]) MaLoNit-	Val (Chap. 2; [34])	MaLoNit-Mul (Chap. 5; [24])
MaLoIt-Nec (Chap. 10; [26])	MaLoIt-Cam (Chap.	12; [6]) MaLoIt-Fa	ır (Chap. 7; [9])	MaLoIt-Nec (Chap. 10; [26])
MaGloNit-Hu (Chap. 13; [15])	MaGloNit-Ted (Chap	. 15; [32]) MaGloIt-F	ro (Chap. 17; [30]	) MaGloIt-Gra (Chap. 18; [13])
MaGloNit-Cas (Chap. 16; [7])	MaGloIt-Pro (Chap.	17; [30]) MoLoIt-Ju	r (Chap. 22; [1])	MoLoIt-Doa (Chap. 24; [8])
MaGloIt-Gis (Chap. 19; [12])	MoLoIt-Doa (Chap.	24; [8]) MoLoIt-Li	u (Chap. 30; [19])	MoGloNit-Oca (Chap. 31; [28
MoLoNit-Bet (Chap. 26; [3])	MoGloNit-Oca (Cha	o. 31; [28]) MoGloIt-H	an (Chap. 34; [29]	)
MoGloNit-Nab (Chap. 33; [25])	MoGloIt-Pan (Chap.	34; [29])		
MoGloIt-Fer2 (Chap. 36; [10])				
Input	Ou	tput	State	
MaLolt-Lem (Cl MaLolt-Lam (Cl MaLolt-Bie (Ch MaLolt-Cam (Cl MaGloNit-Cas ( MaGloIt-Gis (Cl MaGloIt-Ros (Cl	11:1       [17])         ap. 11; [4])       [1]         ap. 12; [6])       [1]         Chap. 16; [7])       [1]         hap. 21; [31])       Ma         hap. 24; [8])       Ma	LoNit-Val (Chap. 2; [3 LoIt-Cam (Chap. 12; [ GloIt-Koz (Chap. 20; ] LoNit-Bet (Chap. 26;	MaLoIt-Far MaLoIt-Bie MaGloNit-H MaGloNit-H 4]) MaGloNit-C 6]) MaGloIt-Gra	1 (Chap. 2; [34]) (Chap. 7; [9]) (Chap. 11; [4]) u (Chap. 13; [15]) er (Chap. 14; [14]) as (Chap. 16; [7]) u (Chap. 18; [13]) (Chap. 19; [12])

 Table 1.6
 Scheme classification with respect to the possible sources of coupling

Architecture		
Decentralized	Distributed	Hierarchical
	MaLoNit-Val (Chap. 2; [34])	
	MaLoNit-Tro(Chap. 3; [33])	
	MaLoNit-Mul (Chap. 5; [24])	
	MaLoIt-Bou (Chap. 6; [5])	
	MaLoIt-Far (Chap. 7; [9])	
	MaLoIt-Lam (Chap. 9; [17])	
	MaLoIt-Nec (Chap. 10; [26])	
	MaLoIt-Bie (Chap. 11; [4])	
	MaLoIt-Cam (Chap. 12; [6])	
	MaGloNit-Hu (Chap. 13; [15])	
	MaGloNit-Ted (Chap. 15; [32])	MaLoNit-Mar (Chap. 4; [22])
	MaGloNit-Cas (Chap. 16; [7])	MaGloIt-Pro (Chap. 17; [30])
	MaGloIt-Gra (Chap. 18; [13])	MaGloIt-Koz (Chap. 20; [16])
MaLoIt-Lem (Chap. 8; [18])	MaGloIt-Gis (Chap. 19; [12])	MoLoIt-Doa (Chap. 24; [8])
MoGloNit-Oca (Chap. 31; [28])	MaGloIt-Koz (Chap. 20; [16])	MoLoIt-Zaf (Chap. 28; [35])
	MaGloIt-Ros (Chap. 21; [31])	MoGloNit-Oca (Chap. 31; [28]
	MoLoIt-Jur (Chap. 22; [1])	MoGloNit-Nab (Chap. 33; [25]
	MoLoIt-Axe (Chap. 23; [2])	-
	MoLoIt-Doa (Chap. 24; [8])	
	MoLoNit-Mae (Chap. 25; [21])	
	MoLoNit-Bet (Chap. 26; [3])	
	MoLoIt-Neg (Chap. 27; [27])	
	MoLoIt-Mae2 (Chap. 29; [20])	
	MoLoIt-Liu (Chap. 30; [19])	
	MoGloNit-Mor (Chap. 32; [23])	
	MoGloIt-Pan (Chap. 34; [29])	
	MoGloIt-Fer (Chap. 35; [11])	
	MoGloIt-Fer2 (Chap. 36; [10])	

 Table 1.7
 Scheme classification with respect to the type of control architecture that the scheme implements

 Table 1.8
 Scheme classification with respect to the controller knowledge

Controller knowledge			
Strictly local		Partially global	
MaLoNit-Val (Chap. 2; [34])	MaLoNit-Tro (Chap. 3; [33])		
MaLoNit-Mar (Chap. 4; [22])	MaLoNit-Mul (Chap. 5; [24])	MaGloNit-Hu (Chap. 13; [15])	MaGloNit-Her (Chap. 14; [14])
MaLoIt-Bou (Chap. 6; [5])	MaLoIt-Far (Chap. 7; [9])	MaGloNit-Ted (Chap. 15; [32])	MaGloNit-Cas (Chap. 16; [7])
MaLoIt-Lem (Chap. 8; [18])	MaLoIt-Lam (Chap. 9; [17])	MaGloIt-Pro (Chap. 17; [30])	MaGloIt-Gra (Chap. 18; [13])
MaLoIt-Nec (Chap. 10; [26])	MaLoIt-Bie (Chap. 11; [4])	MaGloIt-Gis (Chap. 19; [12])	MaGloIt-Koz (Chap. 20; [16])
MaLoIt-Cam (Chap. 12; [6])	MoLoIt-Jur (Chap. 22; [1])	MaGloIt-Ros (Chap. 21; [31])	MoLoIt-Axe (Chap. 23; [2])
MoLoIt-Axe (Chap. 23; [2])	MoLoIt-Doa (Chap. 24; [8])	MoGloNit-Oca (Chap. 31; [28])	MoGloNit-Mor (Chap. 32; [23])
MoLoNit-Mae (Chap. 25; [21])	MoLoNit-Bet (Chap. 26; [3])	MoGloNit-Nab (Chap. 33; [25])	MoGloIt-Pan (Chap. 34; [29])
MoLoIt-Neg (Chap. 27; [27])	MoLoIt-Zaf (Chap. 28; [35])	MoGloIt-Fer (Chap. 35; [11])	MoGloIt-Fer2 (Chap. 36; [10])
MoLoIt-Mae2 (Chap. 29; [20])	MoLoIt-Liu (Chap. 30; [19])		

Computation type			
Iterative		Non-iterative	
MaLoIt-Bou (Chap. 6; [5])	MaLoIt-Far (Chap. 7; [9])		
MaLoIt-Lem (Chap. 8; [18])	MaLoIt-Lam (Chap. 9; [17])		
MaLoIt-Nec (Chap. 10; [26])	MaLoIt-Bie (Chap. 11; [4])	MaLoNit-Val (Chap. 2; [34])	MaLoNit-Tro (Chap. 3; [33])
MaLoIt-Cam (Chap. 12; [6])	MaGloIt-Pro (Chap. 17; [30])	MaLoNit-Mar (Chap. 4; [22])	MaLoNit-Mul (Chap. 5; [24])
MaGloIt-Gra (Chap. 18; [13])	MaGloIt-Gis (Chap. 19; [12])	MaGloNit-Hu (Chap. 13; [15])	MaGloNit-Her (Chap. 14; [14])
MaGloIt-Koz (Chap. 20; [16])	MaGloIt-Ros (Chap. 21; [31])	MaGloNit-Ted (Chap. 15; [32])	MaGloNit-Cas (Chap. 16; [7])
MoLoIt-Jur (Chap. 22; [1])	MoLoIt-Axe (Chap. 23; [2])	MoLoNit-Mae (Chap. 25; [21])	MoLoNit-Bet (Chap. 26; [3])
MoLoIt-Doa (Chap. 24; [8])	MoLoIt-Neg (Chap. 27; [27])	MoGloNit-Oca (Chap. 31; [28])	MoGloNit-Mor (Chap. 32; [23])
MoLoIt-Zaf (Chap. 28; [35])	MoLoIt-Mae2 (Chap. 29; [20])	MoGloNit-Nab (Chap. 33; [25])	
MoLoIt-Liu (Chap. 30; [19])	MoGloIt-Pan (Chap. 34; [29])		
MoGloIt-Fer (Chap. 35; [11])	MoGloIt-Fer2 (Chap. 36; [10])		

 Table 1.9
 Scheme classification with respect to the type of computation used by the scheme

 Table 1.10
 Scheme classification with respect to the attitude shown by the controllers

Controller attitude			
Cooperative		Non-cooperative	
MaLoNit-Val (Chap. 2; [34])	MaLoNit-Tro (Chap. 3; [33])		
MaLoNit-Mul (Chap. 5; [24])	MaLoIt-Bou (Chap. 6; [5])		
MaLoIt-Far (Chap. 7; [9])	MaLoIt-Lem (Chap. 8; [18])		
MaLoIt-Lam (Chap. 9; [17])	MaLoIt-Nec (Chap. 10; [26])		
MaLoIt-Bie (Chap. 11; [4])	MaLoIt-Cam (Chap. 12; [6])	MaLoNit-Mar (Chap. 4; [22])	MaGloNit-Hu (Chap. 13; [15])
MaGloIt-Pro (Chap. 17; [30])	MaGloIt-Gra (Chap. 18; [13])	MaGloNit-Her (Chap. 14; [14])	MaGloNit-Ted (Chap. 15; [32])
MaGloIt-Gis (Chap. 19; [12])	MaGloIt-Koz (Chap. 20; [16])	MaGloNit-Cas (Chap. 16; [7])	MaGloIt-Ros (Chap. 21; [31])
MoLoIt-Jur (Chap. 22; [1])	MoLoIt-Axe (Chap. 23; [2])	MoLoNit-Bet (Chap. 26; [3])	MoLoIt-MaeMun (Chap. 29; [20])
MoLoIt-Doa (Chap. 24; [8])	MoLoNit-Mae (Chap. 25; [21])	MoGloNit-Oca (Chap. 31; [28])	
MoLoIt-Neg (Chap. 27; [27])	MoLoIt-Liu (Chap. 30; [19])		
MoGloNit-Mor (Chap. 32; [23])	MoGloNit-Nab (Chap. 33; [25])		
MoGloIt-Pan (Chap. 34; [29])	MoGloIt-Fer (Chap. 35; [11])		
MoGloIt-Fer2 (Chap. 36; [10])			

 Table 1.11
 Scheme classification with respect to the way in which the communication takes place

Communication			
Serial		Parallel	
		MaLoNit-Val (Chap. 2; [34])	MaLoNit-Tro (Chap. 3; [33])
		MaLoNit-Mar (Chap. 4; [22])	MaLoIt-Bou (Chap. 6; [5])
		MaLoIt-Far (Chap. 7; [9])	MaLoIt-Lem (Chap. 8; [18])
		MaLoIt-Lam (Chap. 9; [17])	MaLoIt-Nec (Chap. 10; [26])
		MaLoIt-Bie (Chap. 11; [4])	MaLoIt-Cam (Chap. 12; [6])
		MaGloNit-Hu (Chap. 13; [15])	MaGloNit-Her (Chap. 14; [14])
		MaGloNit-Cas (Chap. 16; [7])	MaGloIt-Pro (Chap. 17; [30])
MaLoNit-Mul (Chap. 5; [24])	MaLoIt-Cam (Chap. 12; [6])	MaGloIt-Gra (Chap. 18; [13])	MaGloIt-Gis (Chap. 19; [12])
MaGloNit-Ted (Chap. 15; [32])	MoLoIt-Neg (Chap. 27; [27])	MaGloIt-Koz (Chap. 20; [16])	MaGloIt-Ros (Chap. 21; [31])
MoGloNit-Oca (Chap. 31; [28])	MoGloNit-Nab (Chap. 33; [25])	MoLoIt-Jur (Chap. 22; [1])	MoLoIt-Axe (Chap. 23; [2])
		MoLoIt-Doa (Chap. 24; [8])	MoLoNit-Mae (Chap. 25; [21])
		MoLoNit-Bet (Chap. 26; [3])	MoLoIt-Neg (Chap. 27; [27])
		MoLoIt-Zaf (Chap. 28; [35])	MoLoIt-MaeMun (Chap. 29; [20])
		MoLoIt-Liu (Chap. 30; [19])	MoGloNit-Oca (Chap. 31; [28])
		MoGloNit-Mor (Chap. 32; [23])	MoGloIt-Pan (Chap. 34; [29])
		MoGloIt-Fer (Chap. 35; [11])	MoGloIt-Fer2 (Chap. 36; [10])

Timing			
Synchronous		Asynchronous	
MaLoNit-Val (Chap. 2; [34])	MaLoNit-Tro (Chap. 3; [33])		
MaLoNit-Mar (Chap. 4; [22])	MaLoNit-Mul (Chap. 5; [24])		
MaLoIt-Bou (Chap. 6; [5])	MaLoIt-Far (Chap. 7; [9])		
MaLoIt-Lem (Chap. 8; [18])	MaLoIt-Lam (Chap. 9; [17])		
MaLoIt-Nec (Chap. 10; [26])	MaLoIt-Bie (Chap. 11; [4])		
MaLoIt-Cam (Chap. 12; [6])	MaGloNit-Her (Chap. 14; [14])		
MaGloNit-Ted (Chap. 15; [32])	MaGloNit-Cas (Chap. 16; [7])		
MaGloIt-Pro (Chap. 17; [30])	MaGloIt-Gra (Chap. 18; [13])		
MaGloIt-Gis (Chap. 19; [12])	MaGloIt-Koz (Chap. 20; [16])	MaGloNit-Hu (Chap. 13; [15])	MaGloIt-Ros (Chap. 21; [31])
MaGloIt-Ros (Chap. 21; [31])	MoLoIt-Jur (Chap. 22; [1])	MoLoIt-Axe (Chap. 23; [2])	MoLoIt-Zaf (Chap. 28; [35])
MoLoIt-Axe (Chap. 23; [2])	MoLoIt-Doa (Chap. 24; [8])		
MoLoNit-Mae (Chap. 25; [21])	MoLoNit-Bet (Chap. 26; [3])		
MoLoIt-Neg (Chap. 27; [27])	MoLoIt-MaeMun (Chap. 29; [20])		
MoLoIt-Liu (Chap. 30; [19])	MoGloNit-Oca (Chap. 31; [28])		
MoGloNit-Mor (Chap. 32; [23])	MoGloNit-Nab (Chap. 33; [25])		
MoGloIt-Pan (Chap. 34; [29])	MoGloIt-Fer (Chap. 35; [11])		
MoGloIt-Fer2 (Chap. 36; [10])			

 Table 1.12
 Scheme classification with respect to the timing employed in the communication

 Table 1.13
 Scheme classification with respect to the nature of the optimization variables used in the optimization problem

Optimization variables			
Real		Integer	
MaLoNit-Val (Chap. 2; [34])	MaLoNit-Tro (Chap. 3; [33])		
MaLoNit-Mar (Chap. 4; [22])	MaLoNit-Mul (Chap. 5; [24])		
MaLoIt-Bou (Chap. 6; [5])	MaLoIt-Far (Chap. 7; [9])		
MaLoIt-Lem (Chap. 8; [18])	MaLoIt-Lam (Chap. 9; [17])		
MaLoIt-Nec (Chap. 10; [26])	MaLoIt-Bie (Chap. 11; [4])		
MaLoIt-Cam (Chap. 12; [6])	MaGloNit-Hu (Chap. 13; [15])		
MaGloNit-Her (Chap. 14; [14])	MaGloNit-Ted (Chap. 15; [32])		
MaGloNit-Cas (Chap. 16; [7])	MaGloIt-Pro (Chap. 17; [30])		
MaGloIt-Gra (Chap. 18; [13])	MaGloIt-Gis (Chap. 19; [12])	MaGloNit-Ted (Chap. 15; [32])	MaGloIt-Pro (Chap. 17; [30])
MaGloIt-Koz (Chap. 20; [16])	MaGloIt-Ros (Chap. 21; [31])	MoLoIt-Axe (Chap. 23; [2])	MoLoIt-Zaf (Chap. 28; [35])
MoLoIt-Jur (Chap. 22; [1])	MoLoIt-Axe (Chap. 23; [2])		
MoLoIt-Doa (Chap. 24; [8])	MoLoNit-Mae (Chap. 25; [21])		
MoLoNit-Bet (Chap. 26; [3])	MoLoIt-Neg (Chap. 27; [27])		
MoLoIt-Zaf (Chap. 28; [35])	MoLoIt-MaeMun (Chap. 29; [20])		
MoLoIt-Liu (Chap. 30; [19])	MoGloNit-Oca (Chap. 31; [28])		
MoGloNit-Mor (Chap. 32; [23])	MoGloNit-Nab (Chap. 33; [25])		
MoGloIt-Pan (Chap. 34; [29])	MoGloIt-Fer (Chap. 35; [11])		
MoGloIt-Fer2 (Chap. 36; [10])			

Optimality			
Yes		No	
		MaLoNit-Tro (Chap. 3; [33])	MaLoNit-Mar (Chap. 4; [22])
MaLoNit-Val (Chap. 2; [34])	MaLoIt-Bou (Chap. 6; [5])	MaLoNit-Mul (Chap. 5; [24])	MaLoIt-Far (Chap. 7; [9])
MaLoIt-Bie (Chap. 11; [4])	MaLoIt-Cam (Chap. 12; [6])	MaLoIt-Lem (Chap. 8; [18])	MaLoIt-Lam (Chap. 9; [17])
MaGloNit-Her (Chap. 14; [14])	MaGloNit-Cas (Chap. 16; [7])	MaLoIt-Nec (Chap. 10; [26])	MaGloNit-Hu (Chap. 13; [15])
MaGloIt-Gis (Chap. 19; [12])	MaGloIt-Koz (Chap. 20; [16])	MaGloNit-Ted (Chap. 15; [32])	MaGloIt-Pro (Chap. 17; [30])
MaGloIt-Ros (Chap. 21; [31])	MoLoIt-Axe (Chap. 23; [2])	MaGloIt-Gra (Chap. 18; [13])	MoLoIt-Jur (Chap. 22; [1])
MoLoIt-Neg (Chap. 27; [27])	MoLoIt-Liu (Chap. 30; [19])	MoLoIt-Doa (Chap. 24; [8])	MoLoNit-Mae (Chap. 25; [21])
MoGloIt-Pan (Chap. 34; [29])	MoGloIt-Fer (Chap. 35; [11])	MoLoNit-Bet (Chap. 26; [3])	MoLoIt-Zaf (Chap. 28; [35])
MoGloIt-Fer2 (Chap. 36; [10])		MoLoIt-Mae2 (Chap. 29; [20])	MoGloNit-Oca (Chap. 31; [28])
		MoGloNit-Mor (Chap. 32; [23])	MoGloNit-Nab (Chap. 33; [25])

 Table 1.14
 Scheme classification with respect to the availability of optimality guarantees

 Table 1.15
 Scheme classification with respect to the existence of suboptimality bounds

Suboptimality bounds			
Yes		No	
		MaLoNit-Tro (Chap. 3; [33])	MaLoNit-Mar (Chap. 4; [22])
MaLoNit-Val (Chap. 2; [34])	MaLoIt-Far (Chap. 7; [9])	MaLoNit-Mul (Chap. 5; [24])	MaLoIt-Bou (Chap. 6; [5])
MaLoIt-Nec (Chap. 10; [26])	MaLoIt-Bie (Chap. 11; [4])	MaLoIt-Lem (Chap. 8; [18])	MaLoIt-Lam (Chap. 9; [17])
MaLoIt-Cam (Chap. 12; [6])	MaGloNit-Ted (Chap. 15; [32])	MaGloNit-Hu (Chap. 13; [15])	MaGloNit-Her (Chap. 14; [14])
MaGloIt-Gra (Chap. 18; [13])	MaGloIt-Gis (Chap. 19; [12])	MaGloNit-Cas (Chap. 16; [7])	MaGloIt-Pro (Chap. 17; [30])
MaGloIt-Ros (Chap. 21; [31])	MoLoIt-Axe (Chap. 23; [2])	MaGloIt-Koz (Chap. 20; [16])	MoLoIt-Jur (Chap. 22; [1])
MoLoIt-Doa (Chap. 24; [8])	MoLoIt-Liu (Chap. 30; [19])	MoLoNit-Mae (Chap. 25; [21])	MoLoNit-Bet (Chap. 26; [3])
MoGloNit-Oca (Chap. 31; [28])	MoGloIt-Fer (Chap. 35; [11])	MoLoIt-Neg (Chap. 27; [27])	MoLoIt-Zaf (Chap. 28; [35])
MoGloIt-Fer2 (Chap. 36; [10])		MoLoIt-Mae2 (Chap. 29; [20])	MoGloNit-Mor (Chap. 32; [23])
		MoGloNit-Nab (Chap. 33; [25])	MoGloIt-Pan (Chap. 34; [29])

 Table 1.16
 Scheme classification with respect to the availability of stability guarantees

Stability			
Yes		No	
MaLoNit-Val (Chap. 2; [34])	MaLoNit-Tro (Chap. 3; [33])		
MaLoNit-Mul (Chap. 5; [24])	MaLoIt-Nec (Chap. 10; [26])		
MaGloNit-Hu (Chap. 13; [15])	MaGloNit-Her (Chap. 14; [14])	MaLoNit-Mar (Chap. 4; [22])	MaLoIt-Bou (Chap. 6; [5])
MaGloNit-Ted (Chap. 15; [32])	MaGloNit-Cas (Chap. 16; [7])	MaLoIt-Far (Chap. 7; [9])	MaLoIt-Lem (Chap. 8; [18])
MaGloIt-Pro (Chap. 17; [30])	MaGloIt-Gra (Chap. 18; [13])	MaLoIt-Lam (Chap. 9; [17])	MaLoIt-Bie (Chap. 11; [4])
MaGloIt-Gis (Chap. 19; [12])	MoLoIt-Axe (Chap. 23; [2])	MaLoIt-Cam (Chap. 12; [6])	MaGloIt-Koz (Chap. 20; [16])
MoLoIt-Doa (Chap. 24; [8])	MoLoNit-Mae (Chap. 25; [21])	MaGloIt-Ros (Chap. 21; [31])	MoLoIt-Jur (Chap. 22; [1])
MoLoNit-Bet (Chap. 26; [3])	MoLoIt-Zaf (Chap. 28; [35])	MoLoIt-Neg (Chap. 27; [27])	MoGloNit-Oca (Chap. 31; [28])
MoLoIt-Mae2 (Chap. 29; [20])	MoLoIt-Liu (Chap. 30; [19])	MoGloNit-Mor (Chap. 32; [23])	MoGloNit-Nab (Chap. 33; [25])
MoGloIt-Pan (Chap. 34; [29])	MoGloIt-Fer (Chap. 35; [11])		
MoGloIt-Fer2 (Chap. 36; [10])			

 Table 1.17
 Scheme classification with respect to the availability of robustness guarantees

Robustness			
Yes		No	
MaLoNit-Tro (Chap. 3; [33])	MaLoNit-Mul (Chap. 5; [24])	MaLoNit-Val (Chap. 2; [34])	MaLoNit-Mar (Chap. 4; [22])
MaLoIt-Nec (Chap. 10; [26])	MaGloNit-Hu (Chap. 13; [15])	MaLoIt-Bou (Chap. 6; [5])	MaLoIt-Far (Chap. 7; [9])
MaGloNit-Ted (Chap. 15; [32])	MaGloNit-Cas (Chap. 16; [7])	MaLoIt-Lem (Chap. 8; [18])	MaLoIt-Lam (Chap. 9; [17])
MaGloIt-Pro (Chap. 17; [30])	MaGloIt-Gra (Chap. 18; [13])	MaLoIt-Bie (Chap. 11; [4])	MaLoIt-Cam (Chap. 12; [6])
MaGloIt-Gis (Chap. 19; [12])	MoLoIt-Axe (Chap. 23; [2])	MaGloNit-Her (Chap. 14; [14])	MaGloIt-Koz (Chap. 20; [16])
MoLoNit-Mae (Chap. 25; [21])	MoLoNit-Bet (Chap. 26; [3])	MaGloIt-Ros (Chap. 21; [31])	MoLoIt-Jur (Chap. 22; [1])
MoLoIt-Zaf (Chap. 28; [35])	MoLoIt-Mae2 (Chap. 29; [20])	MoLoIt-Doa (Chap. 24; [8])	MoLoIt-Neg (Chap. 27; [27])
MoLoIt-Liu (Chap. 30; [19])	MoGloNit-Oca (Chap. 31; [28])	MoGloNit-Mor (Chap. 32; [23])	MoGloNit-Nab (Chap. 33; [25])
MoGloIt-Pan (Chap. 34; [29])		MoGloIt-Fer (Chap. 35; [11])	MoGloIt-Fer2 (Chap. 36; [10])

Chapter 2	8 88	based distributed MPC Nit-Val [34]
	Process	
System Type	Multiple Autonomous Systems	Decomposed Monolithical System
Process Type	Linear Nonlinear	Hybrid
Type of Model	Transfer function	State Space
Randomness	Deterministic	Non-deterministic
<b>Type of Control</b>	Regulation Tracking	Economic
Coupling Source	Constraints	Objective
	Input Output	State
	Control Architecture	
Architecture	Decentralized Distributed	Hierarchical
Controller Knowledge	Strictly Local	Partially Global
Computation Type	Iterative	Non-iterative
Controller Attitude	Cooperative	Noncooperative
Communication	Serial	Parallel
Timing	Synchronous	Asynchronous
<b>Optimization</b> Variables	Real	Integer
<b>I</b>	Theoretical Propertie	<u> </u>
Optimality	Yes	No
Suboptimality Bounds	Yes	No
	Yes	No
Stability		
Stability Robustness	Yes	No
e e	Yes	No
Robustness Chapter	Cooperative tube-based distr	ibuted MPC for linear uncertain
Robustness	Cooperative tube-based distr systems coupled via con	
Robustness Chapter 3	Cooperative tube-based distr systems coupled via con Process	ibuted MPC for linear uncertain nstraints MaLoNit-Tro [33]
Robustness         Chapter         3         System Type	Cooperative tube-based distr systems coupled via con Process Multiple Autonomous Systems	ibuted MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System
Robustness         Chapter         3         System Type         Process Type	Cooperative tube-based distr systems coupled via cor Process Multiple Autonomous Systems Linear Nonlinear	ibuted MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid
Robustness         Chapter         3         System Type         Process Type         Type of Model	Cooperative tube-based distr systems coupled via con Process Multiple Autonomous Systems Linear Nonlinear Transfer function	ibuted MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness	Cooperative tube-based distr systems coupled via cor Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic	ibuted MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness         Type of Control	Cooperative tube-based distr systems coupled via cor Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking	ibuted MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness	Cooperative tube-based distr systems coupled via con Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints	ibuted MPC for linear uncertain istraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness         Type of Control	Cooperative tube-based distr         systems coupled via con         Process         Multiple Autonomous Systems         Linear       Nonlinear         Transfer function       Deterministic         Regulation       Tracking         Constraints       Input         Output       Output	ributed MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source	Cooperative tube-based distr systems coupled via cor Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture	ributed MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture	Cooperative tube-based distristive         systems coupled via construction         Process         Multiple Autonomous Systems         Multiple Autonomous Systems         Linear       Nonlinear         Transfer function         Deterministic         Regulation       Tracking         Constraints       Output         Control Architecture       Distributed	ibuted MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge	Cooperative tube-based distristive systems         systems coupled via construction         Nonlinear         Multiple Autonomous Systems         Multiple Autonomous Systems         Linear       Nonlinear         Transfer function         Deterministic         Regulation       Tracking         Constraints       Output         Control Architecture         Decentralized       Distributed         Strictly Local       Output	ibuted MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type	Cooperative tube-based distristive systems coupled via construction         Process         Multiple Autonomous Systems         Linear       Nonlinear         Transfer function         Deterministic         Regulation       Tracking         Constraints         Input       Output         Control Architecture         Decentralized       Distributed         Strictly Local         Iterative	ibuted MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude	Cooperative tube-based distristive systems coupled via construction of the systems systems and the systems systems. Systems systems such as a system	ributed MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication	Cooperative tube-based distributed via construction         Systems coupled via construction         Multiple Autonomous Systems         Multiple Autonomous Systems         Linear       Nonlinear         Transfer function       Distributed         Deterministic       Output         Construities       Output         Decentralized       Distributed         Strictly       Local         Iterative       Serial	ibuted MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing	Cooperative tube-based distr systems coupled via cor Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Deterministic Regulation Tracking Control Tracking Control Architecture Decentralized Distributed Strictly Local Iterative Cooperative Serial Synchronous	ibuted MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing	Cooperative tube-based distristive systems coupled via consistence of the systems coupled via conservative systems coupled via conservative systems coupled via conservative systems coupled via conservative co	ibuted MPC for linear uncertain astraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing         Optimization Variables	Cooperative tube-based distr systems coupled via cor Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Deterministic Regulation Tracking Control Tracking Control Architecture Decentralized Distributed Strictly Local Iterative Decentralized Distributed Strictly Local Iterative Serial Synchronous Real	ibuted MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer S
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing         Optimization Variables	Cooperative tube-based distristive systems coupled via consistence of the systems coupled via consistence of the systems coupled via consistence of the systems of the systems of the systems of the system of the	ibuted MPC for linear uncertain astraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer S No
Robustness         Chapter         3       System Type         Process Type       Type of Model         Randomness       Type of Control         Coupling Source       Architecture         Controller Knowledge       Computation Type         Controller Attitude       Communication         Timing       Optimization Variables         Optimality       Suboptimality Bounds	Cooperative tube-based distristive systems coupled via consistence of the system of t	ributed MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer S No No
Robustness         Chapter         3         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing         Optimization Variables	Cooperative tube-based distristive systems coupled via consistence of the systems coupled via consistence of the systems coupled via consistence of the systems of the systems of the systems of the system of the	ributed MPC for linear uncertain nstraints MaLoNit-Tro [33] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer S No

Chapter 4			for distributed NMPC using aw MaLoNit-Mar [22]
		Process	
System Type	Multiple Autono		Decomposed Monolithical System
Process Type	Linear	Nonlinear	Hybrid
Type of Model	Transfer f	function	State Space
Randomness	Determ	inistic	Non-deterministic
Type of Control	Regulation	Tracking	Economic
Coupling Source	Constr	aints	Objective
	Input	Output	State
	Contro	ol Architecture	
Architecture	Decentralized	Distributed	Hierarchical
Controller Knowledge	Strictly	Local	Partially Global
Computation Type	Itera	tive	Non-iterative
<b>Controller Attitude</b>	Cooper	rative	Noncooperative
Communication	Ser	ial	Parallel
Timing	Synchr	onous	Asynchronous
<b>Optimization Variables</b>	Re	al	Integer
	Theore	tical Properties	-
Optimality	Ye	s	No
Suboptimality Bounds	Ye	s	No
Stability	Ye	s	No
Robustness	Ye	s	No
Chapter 5	Distribute		sensus and synchronization it-Mul [24]
		Process	
System Type	Multiple Autono	mous Systems	Decomposed Monolithical System
Process Type	Linear	Nonlinear	
Type of Model	-	Nommean	Hybrid
	Transfer f	Tunction	Hybrid State Space
Randomness	Transfer f Determi	unction	
Randomness Type of Control		unction	State Space
Randomness	Determi	inistic Tracking	State Space Non-deterministic
Randomness Type of Control	Determi Regulation	inistic Tracking	State Space Non-deterministic Economic
Randomness Type of Control	Determi Regulation Constr Input	inistic Tracking aints	State Space Non-deterministic Economic Objective
Randomness Type of Control Coupling Source Architecture	Determi Regulation Constr Input	unction inistic Tracking aints Output	State Space Non-deterministic Economic Objective
Randomness Type of Control Coupling Source Architecture Controller Knowledge	Determi Regulation Constr Input <b>Contro</b>	unction inistic Tracking aints Output ol Architecture Distributed	State Space Non-deterministic Economic Objective State
Randomness Type of Control Coupling Source Architecture	Determi Regulation Constr Input Contro Decentralized	unction inistic Tracking aints Output ol Architecture Distributed Local	State Space Non-deterministic Economic Objective State Hierarchical
Randomness Type of Control Coupling Source Architecture Controller Knowledge	Determi Regulation Constr Input Contro Decentralized Strictly	unction inistic Tracking aints Output ol Architecture Distributed Local ive	State Space Non-deterministic Economic Objective State Hierarchical Partially Global
Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type	Determi Regulation Constr Input Decentralized Strictly Iterat Cooper Seri	unction inistic Tracking aints Output ol Architecture Distributed Local ive rative al	State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative
Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude	Determi Regulation Constr Input Contro Decentralized Strictly Iterat Cooper	unction inistic Tracking aints Output ol Architecture Distributed Local ive rative al	State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative
Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication	Determi Regulation Constr Input Decentralized Strictly Iterat Cooper Seri	unction inistic Tracking aints Output ol Architecture Distributed Local ive rative al onous	State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel
Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing	Determi Regulation Constr Input Decentralized Strictly Iterat Cooper Seri Synchro Rea	unction inistic Tracking aints Output ol Architecture Distributed Local ive rative al onous	State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer
Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables Optimality	Determi Regulation Constr Input Decentralized Strictly Iterat Cooper Seri Synchro Rea	unction inistic Tracking aints Output ol Architecture Distributed Local ive rative al onous al tical Properties	State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer
Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Determi Regulation Constr Input Decentralized Strictly Iterat Cooper Seri Synchro Rea <b>Theore</b>	unction inistic Tracking aints Output ol Architecture Distributed Local ive rative al onous al tical Properties	State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer
Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables Optimality	Determi Regulation Constr Input Decentralized Strictly Iterat Cooper Seri Synchro Rea <b>Theoret</b> Yes	unction inistic Tracking aints Output ol Architecture Distributed Local ive al onous al tical Properties	State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No

Chapter 6			der coupled constraints ecomposition MaLoIt-Bou [5]
		Process	
System Type	Multiple Autono		Decomposed Monolithical System
Process Type	Linear	Nonlinear	Hybrid
Type of Model	Transfer	function	State Space
Randomness	Determ	inistic	Non-deterministic
Type of Control	Regulation	Tracking	Economic
Coupling Source	Const	raints	Objective
	Input	Output	State
	Contr	ol Architecture	
Architecture	Decentralized	Distributed	Hierarchical
Controller Knowledge	Strictly	Local	Partially Global
Computation Type	Itera	tive	Non-iterative
<b>Controller</b> Attitude	Coope		Noncooperative
Communication	Ser	ial	Parallel
Timing	Synchr	onous	Asynchronous
<b>Optimization Variables</b>	Re		Integer
		etical Properties	
Optimality	Ye	-	No
Suboptimality Bounds	Ye	-	No
Stability	Ye	-	No
Robustness	Ye	s	No
Chapter 7			decomposition and alternative ultipliers MaLoIt-Far [9]
-	directio	on method of m Process	
7 System Type		on method of m Process	
7 System Type Process Type	direction Multiple Autono Linear	on method of m Process omous Systems Nonlinear	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid
7 System Type Process Type Type of Model	direction Multiple Autono Linear Transfer f	on method of m Process omous Systems Nonlinear Cunction	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space
7 System Type Process Type Type of Model Randomness	direction Multiple Autono Linear Transfer f Determ	on method of m Process omous Systems Nonlinear function inistic	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic
7 System Type Process Type Type of Model Randomness Type of Control	direction Multiple Autono Linear Transfer f Determ Regulation	Process mous Systems Nonlinear function inistic Tracking	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic
7 System Type Process Type Type of Model Randomness	direction Multiple Autono Linear Transfer f Determ Regulation Constr	Process mous Systems Nonlinear function inistic Tracking aints	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective
7 System Type Process Type Type of Model Randomness Type of Control	direction Multiple Autono Linear Transfer f Determ Regulation Constr Input	Process mous Systems Nonlinear function inistic Tracking taints Output	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic
7 System Type Process Type Type of Model Randomness Type of Control Coupling Source	direction Multiple Autono Linear Transfer f Determ Regulation Constr Input <b>Contro</b>	Process mous Systems Nonlinear function inistic Tracking aints Output Ol Architecture	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State
7 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture	direction Multiple Autono Linear Transfer f Determ Regulation Constr Input Contro Decentralized	Process mous Systems Nonlinear function inistic Tracking aints Output Ol Architecture Distributed	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical
7 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge	direction Multiple Autono Linear Transfer f Determ Regulation Constr Input Contro Decentralized Strictly	Process mous Systems Nonlinear unction inistic Tracking aints Output Ol Architecture Distributed Local	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global
7 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type	direction Multiple Autono Linear Transfer f Determ Regulation Constr Input Contro Decentralized Strictly Iterat	Process mous Systems Nonlinear Sunction inistic Tracking aints Output Ol Architecture Distributed Local tive	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative
7 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude	direction Multiple Autono Linear Transfer f Determ Regulation Constr Input Contro Decentralized Strictly Iterat Cooper	Process mous Systems Nonlinear function inistic Tracking aints Output Distributed Local tive rative	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative
7 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication	direction Multiple Autono Linear Transfer f Determ Regulation Constr Input Contro Decentralized Strictly Iterat Cooper Seri	n method of m Process mous Systems Nonlinear function inistic Tracking aints Output Distributed Local tive rative	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel
7 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing	direction Multiple Autono Linear Transfer f Determ Regulation Constr Input Contro Decentralized Strictly Iterat Coopet Seri Synchr	Process mous Systems Nonlinear function inistic Tracking aints Output Distributed Local tive rative al	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous
7 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication	direction Multiple Autono Linear Transfer f Determ Regulation Constr Input Contro Decentralized Strictly Iterar Cooper Serri Synchr Res	Process mous Systems Nonlinear Function inistic Tracking aints Output Distributed Local tive rative al	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer
7 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	direction Multiple Autono Linear Transfer f Determ Regulation Constr Input Contro Decentralized Strictly Iterar Cooper Seri Synchr Rea <b>Theore</b>	Process mous Systems Nonlinear function inistic Tracking aints Output Distributed Local tive rative al conous al tical Properties	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer
7 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Computation Type Controller Attitude Communication Timing Optimization Variables	direction Multiple Autono Linear Transfer f Determ Regulation Contro Decentralized Decentralized Strictly Iterar Cooper Serri Synchr Res <b>Theore</b> Ye	n method of m Process mous Systems Nonlinear function inistic Tracking aints Output Distributed Local tive rative al tical Properties s	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No
7 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Computation Type Controller Attitude Communication Timing Optimization Variables Optimality Suboptimality Bounds	direction Multiple Auton Linear Transfer f Determ Regulation Contro Decentralized Strictly Iterar Cooper Serri Synchr Res <b>Theore</b> Ye	n method of m Process mous Systems Nonlinear function inistic Tracking aints Output ol Architecture Distributed Local tive rative al conous al tical Properties s	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No No No
7 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Computation Type Controller Attitude Communication Timing Optimization Variables	direction Multiple Autono Linear Transfer f Determ Regulation Contro Decentralized Decentralized Strictly Iterar Cooper Serri Synchr Res <b>Theore</b> Ye	n method of m Process mous Systems Nonlinear Function inistic Tracking aints Output Ol Architecture Distributed Local tive rative al Conous al S S S	ultipliers MaLoIt-Far [9] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No

Chapter 8	· · · · · · · · · · · · · · · · · · ·		IPC with stability constraints roach MaLoIt-Lem [18]
	Proces	s	
System Type	Multiple Autonomous S	~	Decomposed Monolithical System
Process Type	Linear Nonl		Hybrid
Type of Model	Transfer function		State Space
Randomness	Deterministic		Non-deterministic
Type of Control	Regulation Trac	king	Economic
Coupling Source	Constraints	8	Objective
<b>1</b> 8	Input Out	put	State
	Control Arch	1	
Architecture	Decentralized Distri	buted	Hierarchical
Controller Knowledge	Strictly Local		Partially Global
Computation Type	Iterative		Non-iterative
Controller Attitude	Cooperative		Noncooperative
Communication	Serial		Parallel
Timing	Synchronous		Asynchronous
Optimization Variables	Real		Integer
	Theoretical Pr	operties	
Optimality	Yes	•	No
Suboptimality Bounds	Yes		No
Stability	Yes		No
	Yes		
Robustness	Yes		No
Robustness Chapter	A distributed-in-time N		ased coordination mechanism for
Robustness	A distributed-in-time N resource shar	ing prob	
Robustness Chapter 9	A distributed-in-time N resource shar Process	ing prob	ased coordination mechanism for lems MaLoIt-Lam [17]
Robustness Chapter 9 System Type	A distributed-in-time N resource shar Process Multiple Autonomous Sy	ing prob s vstems	ased coordination mechanism for lems MaLoIt-Lam [17] Decomposed Monolithical System
Robustness Chapter 9 System Type Process Type	A distributed-in-time N resource shar Process Multiple Autonomous Sy Linear Nonlin	ing prob s vstems	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid
Robustness         Chapter       9         System Type       Process Type         Type of Model       Yet	A distributed-in-time N resource shar Process Multiple Autonomous Sy Linear Nonlin Transfer function	ing prob s vstems	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space
Robustness         Chapter       9         System Type       Process Type         Type of Model       Randomness	A distributed-in-time N resource shar Process Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic	ing prob s vstems lear	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic
Robustness         Chapter       9         System Type       Process Type         Type of Model       Randomness         Type of Control       Process	A distributed-in-time N resource shar Process Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki	ing prob s vstems lear	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic
Robustness         Chapter       9         System Type       Process Type         Type of Model       Randomness	A distributed-in-time N resource shar Process Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints	ing prob	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective
Robustness         Chapter       9         System Type       Process Type         Type of Model       Randomness         Type of Control       Process	A distributed-in-time N resource shar Process Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints Input Outp	ing prob	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic
Robustness         Chapter       9         System Type       Process Type         Type of Model       Randomness         Type of Control       Coupling Source	A distributed-in-time N resource shar Process Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints Input Outp Control Archi	ing prob s /stems lear ing ut itecture	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State
Robustness         Chapter         9         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture	A distributed-in-time N resource shar Process Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints Input Outp Control Archi Decentralized Distribu	ing prob s /stems lear ing ut itecture	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical
Robustness         Chapter         9         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge	A distributed-in-time N resource shar Process Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints Input Outp Control Archi Decentralized Distribu Strictly Local	ing prob s /stems lear ing ut itecture	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global
Robustness         Chapter         9         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type	A distributed-in-time N resource shar Process Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints Input Outp Control Archi Decentralized Distribu Strictly Local Iterative	ing prob s /stems lear ing ut itecture	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative
Robustness         Chapter         9         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude	A distributed-in-time N resource shar Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints Input Outp Control Archi Decentralized Distribu Strictly Local Iterative Cooperative	ing prob s /stems lear ing ut itecture	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative
Robustness         Chapter         9         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication	A distributed-in-time N resource shar Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints Input Outp Control Archi Decentralized Distribu Strictly Local Iterative Cooperative Serial	ing prob s /stems lear ing ut itecture	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel
Robustness         Chapter         9         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing	A distributed-in-time N resource shar Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints Input Outp Control Archi Decentralized Distribu Strictly Local Iterative Cooperative Serial Synchronous	ing prob s /stems lear ing ut itecture	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous
Robustness         Chapter         9         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing	A distributed-in-time N resource shar Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints Input Outp Control Archi Decentralized Distribu Strictly Local Iterative Cooperative Serial Synchronous Real	ing prob systems hear ing ut itecture hted	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel
Robustness         Chapter         9         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing         Dptimization Variables	A distributed-in-time N resource shar Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints Input Outp Control Archi Decentralized Distribu Strictly Local Iterative Cooperative Serial Synchronous Real	ing prob systems hear ing ut itecture hted	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer
Robustness         Chapter         9         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing         Optimization Variables	A distributed-in-time N resource shar Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints Input Outp Control Archi Decentralized Distribu Strictly Local Iterative Cooperative Serial Synchronous Real Theoretical Pr Yes	ing prob systems hear ing ut itecture hted	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No
Robustness         Chapter         9         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing         Optimization Variables         Optimality         Suboptimality Bounds	A distributed-in-time N resource shar Multiple Auton⊸ous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints Input Outp Control Archi Decentralized Distribu Strictly Local Iterative Cooperative Serial Synchronous Real Theoretical Pr Yes Yes	ing prob systems hear ing ut itecture hted	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No No
Robustness         Chapter         9         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing         Optimization Variables	A distributed-in-time N resource shar Multiple Autonomous Sy Linear Nonlin Transfer function Deterministic Regulation Tracki Constraints Input Outp Control Archi Decentralized Distribu Strictly Local Iterative Cooperative Serial Synchronous Real Theoretical Pr Yes	ing prob systems hear ing ut itecture hted	ased coordination mechanism for olems MaLoIt-Lam [17] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No

Chapter 10		v	xact dual fast gradient d MPC MaLoIt-Nec [26]
		Process	
System Type	Multiple Auton	omous Systems	Decomposed Monolithical System
Process Type	Linear	Nonlinear	Hybrid
Type of Model	Transfer	function	State Space
Randomness	Determ	ninistic	Non-deterministic
Type of Control	Regulation	Tracking	Economic
Coupling Source	Const	raints	Objective
	Input	Output	State
	Contr	ol Architecture	
Architecture	Decentralized	Distributed	Hierarchical
Controller Knowledge	Strictly	Local	Partially Global
Computation Type	Iterative		Non-iterative
Controller Attitude	Coope	rative	Noncooperative
Communication	Ser		Parallel
Timing	Synchi	onous	Asynchronous
Optimization Variables	Re		Integer
• <b>F</b>		etical Properties	0
Optimality	Ye	-	No
Suboptimality Bounds	Ye		No
Stability	Ye		No
Robustness	Ye		No
Robustitess	i.		110
Chapter 11	Dist		ia dual decomposition It-Bie [4]
		WIALO	It-Dic [4]
		Process	
System Type	Multiple Autono	omous Systems	Decomposed Monolithical System
Process Type	Linear	omous Systems Nonlinear	Hybrid
Process Type Type of Model	Linear Transfer	omous Systems Nonlinear function	Hybrid State Space
Process Type Type of Model Randomness	Linear Transfer f Determ	omous Systems Nonlinear function inistic	Hybrid State Space Non-deterministic
Process Type Type of Model Randomness Type of Control	Linear Transfer f Determ Regulation	Nonlinear function inistic Tracking	Hybrid State Space Non-deterministic Economic
Process Type Type of Model Randomness	Linear Transfer f Determ Regulation Constr	omous Systems Nonlinear function inistic Tracking raints	Hybrid State Space Non-deterministic Economic Objective
Process Type Type of Model Randomness Type of Control	Linear Transfer I Determ Regulation Constr Input	Monlinear function inistic Tracking raints Output	Hybrid State Space Non-deterministic Economic
Process Type Type of Model Randomness Type of Control	Linear Transfer I Determ Regulation Constr Input <b>Contr</b>	Monlinear function inistic Tracking raints Output <b>bl Architecture</b>	Hybrid State Space Non-deterministic Economic Objective State
Process Type Type of Model Randomness Type of Control	Linear Transfer I Determ Regulation Constr Input	Monlinear function inistic Tracking raints Output	Hybrid State Space Non-deterministic Economic Objective
Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge	Linear Transfer I Determ Regulation Constr Input <b>Contr</b>	omous Systems Nonlinear function inistic Tracking raints Output <b>ol Architecture</b> Distributed	Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global
Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type	Linear Transfer I Determ Regulation Constr Input Contro Decentralized	omous Systems Nonlinear function inistic Tracking raints Output <b>Di Architecture</b> Distributed Local	Hybrid State Space Non-deterministic Economic Objective State Hierarchical
Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge	Linear Transfer I Determ Regulation Constr Input Contro Decentralized Strictly	omous Systems Nonlinear function inistic Tracking raints Output <b>Di Architecture</b> Distributed Local tive	Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global
Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type	Linear Transfer I Determ Regulation Constr Input Contro Decentralized Strictly Itera	omous Systems Nonlinear function inistic Tracking raints Output <b>Di Architecture</b> Distributed Local tive rative	Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative
Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude	Linear Transfer I Determ Regulation Constr Input Decentralized Strictly Itera Coope	omous Systems Nonlinear function inistic Tracking raints Output <b>Di Architecture</b> Distributed Local tive rative	Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative
Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing	Linear Transfer I Determ Regulation Constr Input Decentralized Strictly Itera Coope Ser	omous Systems Nonlinear function inistic Tracking raints Output <b>Di Architecture</b> Distributed Local tive rative ial onous	Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous
Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication	Linear Transfer I Determ Regulation Constr Input Decentralized Strictly Itera Coope Ser Synchr Re	omous Systems Nonlinear function inistic Tracking aints Output Distributed Local tive rative ial onous al	Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer
Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Linear Transfer I Determ Regulation Constr Input Decentralized Strictly Itera Coope Ser Synchr Re	mous Systems Nonlinear function inistic Tracking raints Output <b>Di Architecture</b> Distributed Local tive rative ial onous al <b>tical Properties</b>	Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer
Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Linear Transfer I Determ Regulation Constr Input Decentralized Strictly Itera Coope Ser Synchr Re <b>Theore</b>	omous Systems Nonlinear function inistic Tracking raints Output <b>Distributed</b> Local tive rative ial onous al <b>tical Properties</b> s	Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer
Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Linear Transfer I Determ Regulation Constr Input Decentralized Strictly Itera Coope Ser Synchr Re <b>Theore</b> Ye	omous Systems Nonlinear function inistic Tracking raints Output <b>Distributed</b> Local tive rative ial onous al <b>tical Properties</b> s	Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No

Chapter 12	Distributed of		MPC of linear dynamic networks [t-Cam [6]
		Process	
System Type	Multiple Auton	omous Systems	Decomposed Monolithical System
Process Type	Linear	Nonlinear	Hybrid
Type of Model	Transfer	function	State Space
Randomness	Detern	ninistic	Non-deterministic
Type of Control	Regulation	Tracking	Economic
Coupling Source	Const	raints	Objective
	Input	Output	State
	Contr	ol Architecture	
Architecture	Decentralized	Distributed	Hierarchical
Controller Knowledge	Strictly	/ Local	Partially Global
Computation Type	Itera	ative	Non-iterative
<b>Controller Attitude</b>	Coope	erative	Noncooperative
Communication	Sei	rial	Parallel
Timing	Synch	ronous	Asynchronous
<b>Optimization Variables</b>	Re	eal	Integer
	Theore	etical Properties	•
Optimality	Ye	es	No
Suboptimality Bounds	Ye	es	No
Stability	Ye	es	No
Robustness	Ye	es	No

#### Chanter Distributed antimization for MPC of line r dynamic network

Chapter	Adaptive quasi-decentralized MPC of networked process systems
13	MaGloNit-Hu [15]

		Process	
System Type	Multiple Autor	nomous Systems	Decomposed Monolithical System
Process Type	Linear	Nonlinear	Hybrid
Type of Model	Transfer	function	State Space
Randomness	Deterministic		Non-deterministic
Type of Control	Regulation Tracking		Economic
Coupling Source	Cons	traints	Objective
	Input	Output	State
	Con	trol Architectu	re
Architecture	Decentralized	Distributed	Hierarchical
Controller Knowledge	Strictl	y Local	Partially Global
Computation Type	Iter	ative	Non-iterative
<b>Controller Attitude</b>	Coop	erative	Noncooperative
Communication	Se	erial	Parallel
Timing	Synch	ironous	Asynchronous
<b>Optimization Variables</b>	R	eal	Integer
	Theo	oretical Properti	ies
Optimality	У	/es	No
Suboptimality Bounds	У	es	No
Stability	γ	/es	No
Robustness	Y	/es	No

Chapter 14	Distributed Lyapunov-based MPC MaGloNit-Her [14]		
	Process		
System Type	Multiple Autonomous Systems	Decomposed Monolithical System	
Process Type	Linear Nonlinear	Hybrid	
Type of Model	Transfer function	State Space	
Randomness	Deterministic	Non-deterministic	
Type of Control	Regulation Tracking	Economic	
Coupling Source	Constraints	Objective	
I O	Input Output	State	
	Control Architecture		
Architecture	Decentralized Distributed	Hierarchical	
Controller Knowledge	Strictly Local	Partially Global	
Computation Type	Iterative	Non-iterative	
Controller Attitude	Cooperative	Noncooperative	
Communication	Serial	Parallel	
Timing	Synchronous	Asynchronous	
Optimization Variables	Real	Integer	
	Theoretical Properties		
Optimality	Yes	No	
Suboptimality Bounds	Yes	No	
Stability	Yes	No	
		110	
Robustness	Yes	No	
Robustness Chapter	A distributed reference manage	ement scheme in presence of non-	
Robustness	A distributed reference manage convex constraints: an MPC ba		
Robustness Chapter 15	A distributed reference manage convex constraints: an MPC ba Process	ement scheme in presence of non- sed approach MaGloNit-Ted [32]	
Robustness Chapter 15 System Type	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System	
Robustness Chapter 15 System Type Process Type	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid	
Robustness Chapter 15 System Type Process Type Type of Model	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space	
Robustness Chapter 15 System Type Process Type Type of Model Randomness	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic	
Robustness Chapter 15 System Type Process Type Type of Model Randomness Type of Control	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic	
Robustness Chapter 15 System Type Process Type Type of Model Randomness	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective	
Robustness Chapter 15 System Type Process Type Type of Model Randomness Type of Control	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic	
Robustness         Chapter         15         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State	
Robustness         Chapter         15         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical	
Robustness         Chapter         15         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed Strictly Local	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global	
Robustness         Chapter         15         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed Strictly Local Iterative	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative	
Robustness         Chapter         15         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed Strictly Local Iterative Cooperative	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative	
Robustness         Chapter         15         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed Strictly Local Iterative Cooperative Serial	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel	
Robustness         Chapter         15         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed Strictly Local Iterative Cooperative Serial Synchronous	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous	
Robustness         Chapter         15         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed Strictly Local Iterative Cooperative Serial Synchronous Real	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel	
Robustness         Chapter         15         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing         Optimization Variables	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed Strictly Local Iterative Cooperative Serial Synchronous Real Theoretical Properties	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer	
Robustness         Chapter         15         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing         Optimization Variables	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed Strictly Local Iterative Cooperative Serial Synchronous Real Theoretical Properties Yes	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No	
Robustness         Chapter         15         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing         Optimization Variables         Optimality         Suboptimality Bounds	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed Strictly Local Iterative Cooperative Serial Synchronous Real Theoretical Properties Yes	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No No	
Robustness         Chapter         15         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type         Controller Attitude         Communication         Timing         Optimization Variables	A distributed reference manage convex constraints: an MPC ba Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed Strictly Local Iterative Cooperative Serial Synchronous Real Theoretical Properties Yes	ement scheme in presence of non- sed approach MaGloNit-Ted [32] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No	

Chapter 16	The distributed command governor approach in a nutshell MaGloNit-Cas [7]		
	Process		
System Type	Multiple Autonomous Systems	Decomposed Monolithical System	
Process Type	Linear Nonlinear	Hybrid	
Type of Model	Transfer function	State Space	
Randomness	Deterministic	Non-deterministic	
Type of Control	Regulation Tracking	Economic	
Coupling Source	Constraints	Objective	
	Input Output	State	
	Control Architecture		
Architecture	Decentralized Distributed	Hierarchical	
Controller Knowledge	Strictly Local	Partially Global	
Computation Type	Iterative	Non-iterative	
<b>Controller Attitude</b>	Cooperative	Noncooperative	
Communication	Serial	Parallel	
Timing	Synchronous	Asynchronous	
<b>Optimization Variables</b>	Real	Integer	
	Theoretical Properties	s	
Optimality	Yes	No	
Suboptimality Bounds	Yes	No	
		No	
Suboptimality Doulids Stability	Yes	INO	
	Yes Yes	No	
Stability			
Stability Robustness Chapter	Yes Mixed-integer prog	No ramming techniques in	
Stability Robustness	Yes Mixed-integer prog distributed MPC pro	No	
Stability Robustness Chapter 17	Yes Mixed-integer prog distributed MPC pro Process	No ramming techniques in blems MaGloIt-Pro [30]	
Stability Robustness Chapter 17 System Type	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System	
Stability Robustness Chapter 17 System Type Process Type	Yes Mixed-integer prog distributed MPC pro Process	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid	
Stability Robustness Chapter 17 System Type Process Type Type of Model	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems Linear Nonlinear Transfer function	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness Type of Control	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems Linear Nonlinear Transfer function	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness Type of Control	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness Type of Control	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed Strictly Local	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed Strictly Local Iterative	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Regulation Tracking Control Architecture Decentralized Distributed Strictly Local Iterative Cooperative Serial	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architecture Decentralized Distributed Strictly Local Iterative Cooperative	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing	Yes       Mixed-integer prog distributed MPC pro       Multiple Autonomous Systems       Linear     Nonlinear       Transfer function       Deterministic       Regulation     Tracking       Control Architecture       Decentralized     Distributed       Strictly Local       Iterative       Coperative       Serial       Synchronous       Real	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing	Yes Mixed-integer prog distributed MPC pro Process Multiple Autonomous Systems Linear Nonlinear Transfer function Deterministic Regulation Tracking Control Architecture Decentralized Distributed Strictly Local Iterative Cooperative Serial Synchronous	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer	
Stability Robustness         Chapter 17         System Type Process Type Type of Model Randomness Type of Control Coupling Source         Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Yes         Mixed-integer prog distributed MPC pro         Multiple Autonomous Systems         Linear       Nonlinear         Transfer function         Deterministic         Regulation       Tracking         Control Architecture         Decentralized       Distributed Strictly Local         Iterative       Coperative         Serial       Synchronous         Real       Theoretical Properties	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer	
Stability Robustness Chapter 17 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Yes       Mixed-integer prog distributed MPC pro       Base of the set	No ramming techniques in blems MaGloIt-Pro [30] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No	

Chapter 18			connected nonlinear systems position MaGloIt-Gra [13]
		Process	
System Type	Multiple Auton	omous Systems	Decomposed Monolithical System
Process Type	Linear	Nonlinear	Hybrid
Type of Model	Transfer	function	State Space
Randomness	Determ	ninistic	Non-deterministic
Type of Control	Regulation	Tracking	Economic
Coupling Source	Const	raints	Objective
	Input	Output	State
	Contr	ol Architecture	
Architecture	Decentralized	Distributed	Hierarchical
Controller Knowledge	Strictly	/ Local	Partially Global
Computation Type	Itera	tive	Non-iterative
<b>Controller Attitude</b>	Coope	erative	Noncooperative
Communication	Ser	ial	Parallel
Timing	Synchi	ronous	Asynchronous
<b>Optimization Variables</b>	Re	al	Integer
	Theore	etical Properties	5
Optimality	Ye	es	No
Suboptimality Bounds	Ye	es	No
Stability	Ye	es	No
Robustness	Ye	es	No

# Distributed MPC of interconnected nonlinear systems

Chapter 19 Generalized accelerated gradient methods for distributed MPC based on dual decomposition MaGloIt-Gis [12]

		Process	
System Type	Multiple Autor	nomous Systems	Decomposed Monolithical System
Process Type	Linear	Nonlinear	Hybrid
Type of Model	Transfer function		State Space
Randomness	Deterr	ministic	Non-deterministic
Type of Control	Regulation	Tracking	Economic
Coupling Source	Cons	straints	Objective
	Input	Output	State
	Cont	trol Architecture	
Architecture	Decentralized	Distributed	Hierarchical
Controller Knowledge	Strictl	y Local	Partially Global
Computation Type	Iter	ative	Non-iterative
<b>Controller Attitude</b>	Coop	erative	Noncooperative
Communication	Se	erial	Parallel
Timing	Synch	nronous	Asynchronous
<b>Optimization Variables</b>	R	eal	Integer
_	Theo	retical Properties	_
Optimality	У	les	No
Suboptimality Bounds	У	les	No
Stability	Ŋ	les	No
Robustness	У	les	No

Chapter 20			ple shooting for large tems MaGloIt-Koz [16]
		Process	
System Type	Multiple Auton	omous Systems	Decomposed Monolithical System
Process Type	Linear	Nonlinear	Hybrid
Type of Model	Transfer	function	State Space
Randomness		ninistic	Non-deterministic
Type of Control	Regulation	Tracking	Economic
Coupling Source	Const	traints	Objective
	Input	Output	State
	Contr	ol Architecture	
Architecture		Distributed	Hierarchical
Controller Knowledge	Strictly	y Local	Partially Global
Computation Type	Itera	ative	Non-iterative
<b>Controller Attitude</b>	Coope	erative	Noncooperative
Communication	Sei	rial	Parallel
Timing	Synch	ronous	Asynchronous
<b>Optimization Variables</b>	Re	eal	Integer
	Theore	etical Properties	5
Optimality	Ye	es	No
Suboptimality Bounds	Ye	es	No
Stability	Ye	es	No
Robustness	Ye	es	No
Chapter	Nash-bas		MPC for multi-rate systems
21		MaGlo	It-Ros [31]
		Process	
System Type	Multiple Autono	•	Decomposed Monolithical System
Process Type	Linear	Nonlinear	Hybrid
Type of Model	Transfer		State Space
Randomness	Determ		Non-deterministic
Type of Control	Regulation	Tracking	Economic
<b>Coupling Source</b>	Const		Objective
	Input	Output	State
		ol Architecture	
Architecture	Decentralized	Distributed	Hierarchical
Controller Knowledge	Strictly		Partially Global
Computation Type	Itera		Non-iterative
<b>Controller Attitude</b>	Coope		Noncooperative
Communication	Ser		Parallel
Timing	Synchr		Asynchronous
<b>Optimization Variables</b>	Re		Integer
•		4! 1 D	
-		etical Properties	
Optimality	Ye	es	No
Optimality Suboptimality Bounds	Ye Ye	es es	No No
Optimality	Ye	es es es	No

Chapter 22	Cooperative dynamic MPC for networked control systems MoLoIt-Jur [1]		
	Process		
System Type	Multiple Autonomous System	s Decomposed Monolithical System	
Process Type	Linear Nonlinear	Hybrid	
Type of Model	Transfer function	State Space	
Randomness	Deterministic	Non-deterministic	
Type of Control	Regulation Tracking	Economic	
Coupling Source	Constraints	Objective	
	Input Output	State	
	Control Architectu	re	
Architecture	Decentralized Distributed	Hierarchical	
Controller Knowledge	Strictly Local	Partially Global	
Computation Type	Iterative	Non-iterative	
Controller Attitude	Cooperative	Noncooperative	
Communication	Serial	Parallel	
Timing	Synchronous	Asynchronous	
Optimization Variables	Real	Integer	
<b>T</b>	Theoretical Propert	e e	
Optimality	Yes	No	
Suboptimality Bounds	Yes	No	
Stability	Yes	No	
Robustness	Yes	No	
Chapter	Parallel implem	entation of hybrid MPC	
Chapter 23		entation of hybrid MPC LoIt-Axe [2]	
*	Mol	LoIt-Axe [2]	
23	Mol Process	LoIt-Axe [2]	
23 System Type	Mol Process Multiple Autonomous System	s Decomposed Monolithical System	
23 System Type Process Type	Mol Process Multiple Autonomous System Linear Nonlinear	s Decomposed Monolithical System Hybrid	
23 System Type Process Type Type of Model Randomness	Mol Process Multiple Autonomous System Linear Nonlinear Transfer function Deterministic	s Decomposed Monolithical System Hybrid State Space	
23 System Type Process Type Type of Model Randomness Type of Control	Mol Process Multiple Autonomous System Linear Nonlinear Transfer function Deterministic Regulation Tracking	s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic	
23 System Type Process Type Type of Model Randomness	Mol Process Multiple Autonomous System Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints	s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective	
23 System Type Process Type Type of Model Randomness Type of Control	Mol Process Multiple Autonomous System Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output	s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State	
23 System Type Process Type Type of Model Randomness Type of Control Coupling Source	Mol Process Multiple Autonomous System Linear Nonlinear Transfer function Deterministic Regulation Tracking Constraints Input Output Control Architectu	s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State re	
23 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture	Mol Process Multiple Autonomous System Linear Nonlinear Transfer Function Deterministic Regulation Tracking Constraints Input Output Contro Architectur Decentralized Distributed	s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State re Hierarchical	
23 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge	Mol Process Multiple Auton→ous System Linear Nonlinear Transfer Function Deterministic Regulation Tracking Constraints Input Output Control Architectur Decentralized Distributed Strictly Local	s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State re Hierarchical Partially Global	
23 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type	Mol Process Multiple Auton→ous System Linear Nonlinear Transfer Function Deterministic Regulation Tracking Constraints Input Output Control Architectur Decentralized Distributed Strictly Local Iterative	s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State re Hierarchical Partially Global Non-iterative	
23 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude	Mol Process Multiple Auton→mous System Linear Nonlinear Transfer Function Deterministic Regulation Tracking Constraints Input Output Control Architectur Decentralized Distributed Strictly Local Iterative Cooperative	s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State re Hierarchical Partially Global Non-iterative Noncooperative	
23 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication	Mol Process Multiple Autonomous System Linear Nonlinear Transfer Function Deterministic Regulation Tracking Constraints Input Output Control Architectur Decentralized Distributed Strictly Local Iterative Cooperative Serial	s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State re Hierarchical Partially Global Non-iterative Noncooperative Parallel	
23 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing	Mol Process Multiple Autononous System Linear Nonlinear Transfer Function Deterministic Regulation Tracking Constraints Input Output Control Architectut Decentralized Distributed Strictly Local Iterative Coop=ative Synchronous	s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous	
23 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing	Mol Process Multiple Autonomous System Linear Nonlinear Transfer Function Deterministic Regulation Tracking Constraints Input Output Control Varchitectu Decentralized Distributed Strictly Local Iterative Cooperative Serial Synchrous Real	s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer	
23 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Dptimization Variables	Mol Process Multiple Auton System Linear Nonlinear Transfer Function Deterministic Regulation Constraints Input Contro Contro Local Iterative Cooperative Serial Synch Nous Real Theoretical Propert	s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer	
23 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Dptimization Variables	Mol       Process       Multiple Autonomous System       Linear     Nonlinear       Transfer Function       Deterministic       Regulation     Tracking       Constraints       Input     Output       Control     Architectu       Decentralized     Distributed       Strictly Local     Iterative       Coop=rative     Serial       Synchrous     Real       Theoretical Propert	LoIt-Axe [2] s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer	
23 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Dptimization Variables Optimality Suboptimality Bounds	Mol       Process       Multiple Autonomous System       Linear     Nonlinear       Transfer Function     Transfer       Deterministic     System       Regulation     Tracking       Constraints     Output       Input     Output       Constraints     Output       Decentralized     Distributed       Strictly Local     Iterative       Cooperative     Serial       Synchrous     Real       Theoretical Propert       Yes     Yes	LoIt-Axe [2] s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer	
23 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Mol       Process       Multiple Autonomous System       Linear     Nonlinear       Transfer Function       Deterministic       Regulation     Tracking       Constraints       Input     Output       Control     Architectu       Decentralized     Distributed       Strictly Local     Iterative       Coop=rative     Serial       Synchrous     Real       Theoretical Propert	LoIt-Axe [2] s Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer	

Robustness

Chapter 24			h with guaranteed feasibility for ar systems MoLoIt-Doa [8]
	-	Process	
System Type	Multiple Auton	omous Systems	Decomposed Monolithical System
Process Type	Linear	Nonlinear	Hybrid
Type of Model	Transfer	function	State Space
Randomness	Determ	ninistic	Non-deterministic
Type of Control	Regulation	Tracking	Economic
Coupling Source	Const	raints	Objective
10	Input	Output	State
		ol Architecture	
Architecture	Decentralized	Distributed	Hierarchical
Controller Knowledge	Strictly	/ Local	Partially Global
Computation Type	Itera	tive	Non-iterative
Controller Attitude	Cooperative		Noncooperative
Communication	Serial		Parallel
Timing	Synchr	ronous	Asynchronous
Optimization Variables	Re		Integer
• F		etical Properties	8
Optimality	Ye		No
Suboptimality Bounds	Ye		No
Stability	Ye		No
Robustness	Ye		No
Chapter	Dis	tributed MPC b	ased on a team game
Chapter 25	Dis		ased on a team game t-Mae [21]
-		MoLoNi Process	0
25 System Type	Dis Multiple Autono	MoLoNi Process	t-Mae [21]
25 System Type Process Type		MoLoNi Process	t-Mae [21]
25 System Type Process Type Type of Model	Multiple Autono	MoLoNi Process omous Systems Nonlinear	t-Mae [21] Decomposed Monolithical System
25 System Type Process Type	Multiple Autono Linear	MoLoNi Process omous Systems Nonlinear function	t-Mae [21] Decomposed Monolithical System Hybrid
25 System Type Process Type Type of Model	Multiple Autono Linear Transfer 1	MoLoNi Process omous Systems Nonlinear function	t-Mae [21] Decomposed Monolithical System Hybrid State Space
25 System Type Process Type Type of Model Randomness	Multiple Autono Linear Transfer Determ	MoLoNi Process omous Systems Nonlinear function inistic Tracking	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic
25 System Type Process Type Type of Model Randomness Type of Control	Multiple Autono Linear Transfer Determ Regulation	MoLoNi Process omous Systems Nonlinear function inistic Tracking	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic
25 System Type Process Type Type of Model Randomness Type of Control	Multiple Autono Linear Transfer f Determ Regulation Constr Input	MoLoNi Process omous Systems Nonlinear function inistic Tracking raints	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective
25 System Type Process Type Type of Model Randomness Type of Control	Multiple Autono Linear Transfer f Determ Regulation Constr Input	MoLoNi Process omous Systems Nonlinear function inistic Tracking raints Output	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective
25 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture	Multiple Autono Linear Transfer f Determ Regulation Constr Input Contro Decentralized	MoLoNi Process Demous Systems Nonlinear function inistic Tracking raints Output Ol Architecture Distributed	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical
25 System Type Process Type Type of Model Randomness Type of Control Coupling Source	Multiple Autono Linear Transfer f Determ Regulation Constr Input <b>Contro</b>	MoLoNi Process Monlinear function inistic Tracking raints Output Ol Architecture Local	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State
25 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type	Multiple Autono Linear Transfer f Determ Regulation Constri Input Contro Decentralized Strictly Itera	MoLoNi Process Monlinear function inistic Tracking raints Output Distributed Local tive	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative
25 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge	Multiple Autono Linear Transfer f Determ Regulation Constri Input Contro Decentralized Strictly	MoLoNi Process Monlinear function inistic Tracking raints Output Distributed Local tive rative	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global
25 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication	Multiple Autono Linear Transfer 1 Determ Regulation Constri Input Contro Decentralized Strictly Itera Coope Ser	MoLoNi Process Monlinear function inistic Tracking raints Output Distributed Local tive rative ial	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel
25 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing	Multiple Autono Linear Transfer f Determ Regulation Constri Input Contro Decentralized Strictly Itera Coope Ser Synchr	MoLoNi Process Monlinear function inistic Tracking raints Output Ol Architecture Distributed Local tive rative ial onous	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous
25 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication	Multiple Autono Linear Transfer I Determ Regulation Constri Input Decentralized Decentralized Strictly Itera Coope Ser Synchr Re	MoLoNi Process Monlinear Nonlinear function inistic Tracking raints Output Obtributed Local tive rative ial onous al	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel
25 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Multiple Autono Linear Transfer f Determ Regulation Constr Input Decentralized Strictly Itera Coope Ser Synchr Re <b>Theore</b>	MoLoNi Process Monlinear function inistic Tracking raints Output Ol Architecture Distributed Local tive rative ial onous al tical Properties	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer
25 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Multiple Autono Linear Transfer f Determ Regulation Constri Input Decentralized Strictly Itera Coope Ser Synchr Re <b>Theore</b> Ye	MoLoNi Process Diversion Systems Nonlinear function inistic Tracking raints Output OUt	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No
25 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Multiple Autono Linear Transfer f Determ Regulation Constr Input Decentralized Strictly Itera Coope Ser Synchr Re <b>Theore</b>	MoLoNi Process Systems Nonlinear function inistic Tracking raints Output OLArchitecture Distributed Local tive rative rative ial onous al tical Properties s s	t-Mae [21] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer

Yes

No

Chapter 26	Distributed re	MPC: A nonco obustness concep	ooperative approach based on pts MoLoNit-Bet [3]
		Process	
System Type	Multiple Autono	omous Systems	Decomposed Monolithical System
Process Type	Linear	Nonlinear	Hybrid
Type of Model	Transfer	function	State Space
Randomness	Determ	inistic	Non-deterministic
Type of Control	Regulation	Tracking	Economic
Coupling Source	Constr	raints	Objective
	Input	Output	State
	Contr	ol Architecture	
Architecture	Decentralized	Distributed	Hierarchical
Controller Knowledge	Strictly	Local	Partially Global
Computation Type	Itera	tive	Non-iterative
Controller Attitude	Coope	rative	Noncooperative
Communication	Ser		Parallel
Timing	Synchr	onous	Asynchronous
<b>Optimization Variables</b>	Re	al	Integer
	Theore	tical Properties	0
Optimality	Ye		No
Suboptimality Bounds	Ye		No
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	N/		No
Stability	Yes		
Stability Robustness	Ye		No
Robustness Chapter	Ye	s of augmented	No Lagrange formulations for serial
Robustness	Ye Decompositions and par	s of augmented	No
Robustness Chapter 27	Ye Decompositions and par	s of augmented i rallel distributed	No Lagrange formulations for serial d MPC MoLoIt-Neg [27]
Robustness       Chapter       27       System Type	Ye Decompositions and par Multiple Autono	s of augmented i rallel distributed Process mous Systems	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System
Robustness         Chapter         27         System Type         Process Type	Ye Decompositions and par Multiple Autono Linear	s of augmented i rallel distributed Process mous Systems Nonlinear	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid
Robustness         Chapter         27         System Type         Process Type         Type of Model	Ye Decompositions and par Multiple Autono Linear Transfer f	s of augmented i rallel distributed Process mous Systems Nonlinear unction	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space
Robustness         Chapter         27         System Type         Process Type         Type of Model         Randomness	Ye Decompositions and par Multiple Autono Linear Transfer f Determi	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic
Robustness         Chapter         27         System Type         Process Type         Type of Model         Randomness         Type of Control	Ye Decompositions and par Multiple Autono Linear Transfer f Determi Regulation	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic
Robustness         Chapter         27         System Type         Process Type         Type of Model         Randomness	Decompositions and par Multiple Autono Linear Transfer f Determi Regulation Constra	s of augmented f rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective
Robustness         Chapter         27         System Type         Process Type         Type of Model         Randomness         Type of Control	Decompositions and par Multiple Autono Linear Transfer f Determi Regulation Constra Input	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints Output	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic
Robustness         Chapter         27         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source	Decompositions and par Multiple Autono Linear Transfer f Determi Regulation Constra Input <b>Contro</b>	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints Output ol Architecture	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State
Robustness         Chapter         27         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture	Ve Decompositions and par Multiple Autono Linear Transfer f Determi Regulation Constra Input Contro Decentralized	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints Output ol Architecture Distributed	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical
Robustness         Chapter         27         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge	Decompositions and par Multiple Autono Linear Transfer f Determi Regulation Constr Input Contro Decentralized Strictly	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints Output ol Architecture Distributed Local	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global
Robustness         Chapter         27         System Type         Process Type         Type of Model         Randomness         Type of Control         Coupling Source         Architecture         Controller Knowledge         Computation Type	Decompositions and par Multiple Autono Linear Transfer f Determi Regulation Constr Input Contro Decentralized Strictly Iterat	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints Output ol Architecture Distributed Local ive	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative
Robustness         Chapter 27         System Type 7         System Type of Model Randomness Type of Model Randomness Type of Control Coupling Source         Architecture Control Coupling Source         Architecture Controller Knowledge Computation Type Controller Attitude	Decompositions and par Multiple Autono Linear Transfer f Determi Regulation Constr Input Contro Decentralized Strictly Iterat Cooper	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints Output Di Architecture Distributed Local ive ative	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative
Robustness         Chapter 27         System Type 7         System Type 0f Model Randomness Type of Model Randomness Type of Control Coupling Source         Architecture Control Coupling Source         Architecture Controller Knowledge Computation Type Controller Attitude Communication	Decompositions and par Multiple Autono Linear Transfer f Determi Regulation Constr Input Contro Decentralized Strictly Iterat Cooper Seri	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints Output Distributed Local ive ative al	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel
Robustness         Chapter 27         System Type 7         Process Type 7         Type of Model Randomness Type of Control Coupling Source         Architecture         Controller Knowledge Computation Type Controller Attitude Communication Timing	Ve Decompositions and par Multiple Autono Linear Transfer f Determi Regulation Constr Input Contro Decentralized Strictly Iterat Cooper Seri Synchro	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints Output Distributed Local ive ative al ponous	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous
Robustness         Chapter 27         System Type 7         Process Type 7         Type of Model Randomness Type of Control Coupling Source         Architecture Control Coupling Source         Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing	Ve Decompositions and par Multiple Autono Linear Transfer f Determi Regulation Constra Input Contro Decentralized Strictly Iterat Cooper Seri Synchro Rea	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints Output Distributed Local ive ative al pnous d	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel
Robustness         Chapter 27         System Type 7         System Type 9         Process Type 7         Type of Model 8         Randomness 7         Type of Control Coupling Source         Architecture         Controller Knowledge Computation Type Controller Attitude Communication Timing 0         Timing Optimization Variables	Ve Decompositions and par Multiple Autono Linear Transfer f Determi Regulation Constra Input Contro Decentralized Strictly Iterat Cooper Seri Synchro Rea <b>Theore</b>	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints Output Distributed Local ive ative al pnous dl tical Properties	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer
Robustness         Chapter 27         System Type 7         Process Type 7         Type of Model Randomness 7         Type of Control Coupling Source         Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing 0         Timing 0         Optimization Variables	Verify of the second se	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints Output Distributed Local ive ative al pnous dl tical Properties	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No
Robustness         Chapter 27         System Type 7         Process Type 7         Type of Model Randomness Type of Control Coupling Source         Architecture         Controller Knowledge Computation Type Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables         Optimization Variables	Decompositions and par Multiple Autono Linear Transfer f Determi Regulation Constr Input Contro Decentralized Strictly Iterat Cooper Seri Synchro Rea Theore Yes	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints Output Distributed Local ive ative al pnous dl tical Properties	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No No No
Robustness         Chapter 27         System Type 7         Process Type 7         Type of Model Randomness 7         Type of Control Coupling Source         Architecture         Controller Knowledge Computation Type Controller Knowledge Computation Type Controller Attitude Communication Timing 0         Timing 0         Optimization Variables	Verify of the second se	s of augmented i rallel distributed Process mous Systems Nonlinear unction nistic Tracking aints Output Distributed Local ive ative al pnous dl tical Properties	No Lagrange formulations for serial d MPC MoLoIt-Neg [27] Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No

Chapter 28	A hierarchical distributed MPC approach: A practical implementation MoLoIt-Zaf [35]			
		Process		
System Type	Multiple Autono	omous Systems	Decomposed Monolithical System	
Process Type	Linear	Nonlinear	Hybrid	
Type of Model	Transfer function		State Space	
Randomness	Determ	inistic	Non-deterministic	
Type of Control	Regulation	Tracking	Economic	
Coupling Source	Const	raints	Objective	
	Input	Output	State	
	Contr	ol Architecture		
Architecture	Decentralized	Distributed	Hierarchical	
Controller Knowledge	Strictly	Local	Partially Global	
Computation Type	Itera	tive	Non-iterative	
Controller Attitude	Coope	rative	Noncooperative	
Communication	Ser		Parallel	
Timing	Synchr	onous	Asynchronous	
<b>Optimization</b> Variables	Re		Integer	
- <b>I</b> · · · · · · · · · · · · · · · · · · ·		tical Properties		
Optimality	Ye	-	No	
Suboptimality Bounds	Ye	s	No	
Stability	Ye	s	No	
Robustness	Yes		No	
Chapter 29	Distributed MPC Based on MoLoIt-Mae2			
	Process			
System Type	Multiple Autono		Decomposed Monolithical System	
Process Type	Linear	Nonlinear	Hybrid	
Type of Model	Transfer function		State Space	
Randomness	Determ		Non-deterministic	
Type of Control	Regulation	Tracking	Economic	
Coupling Source	Constr		Objective	
coupling source	Input		State	
	Contro		State	
Architecture		ol Architecture		
Architecture Controller Knowledge	Decentralized	Distributed	Hierarchical	
Controller Knowledge	Decentralized Strictly	Distributed Local	Hierarchical Partially Global	
Controller Knowledge Computation Type	Decentralized Strictly Iterat	Distributed Local Live	Hierarchical Partially Global Non-iterative	
Controller Knowledge Computation Type Controller Attitude	Decentralized Strictly Iterat Cooper	Distributed Distributed Local tive rative	Hierarchical Partially Global Non-iterative Noncooperative	
Controller Knowledge Computation Type Controller Attitude Communication	Decentralized Strictly Iterat Cooper Series	Distributed Distributed Local tive rative ial	Hierarchical Partially Global Non-iterative Noncooperative Parallel	
Controller Knowledge Computation Type Controller Attitude Communication Timing	Decentralized Strictly Itera Cooper Seri Synchr	Distributed Distributed Local tive rative al onous	Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous	
Controller Knowledge Computation Type Controller Attitude Communication Timing	Decentralized Strictly Iterar Cooper Seri Synchr Rea	Distributed Distributed Local tive rative al onous al	Hierarchical Partially Global Non-iterative Noncooperative Parallel	
Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Decentralized Strictly Itera Coope Seri Synchr Rea <b>Theore</b>	Distributed Distributed Local tive rative al onous al tical Properties	Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer	
Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables Optimality	Decentralized Strictly Itera Cooper Seri Synchr Rez <b>Theore</b> Ye	Distributed Distributed Local tive rative al onous al tical Properties s	Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No	
Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables Optimality Suboptimality Bounds	Decentralized Strictly Itera Cooper Seri Synchr Rez <b>Theore</b> Ye Ye	Distributed Distributed Local tive rative al onous al tical Properties s	Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No No	
Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables Optimality	Decentralized Strictly Itera Cooper Seri Synchr Rez <b>Theore</b> Ye	Distributed Distributed Local tive rative al onous al tical Properties s s	Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer No	

Chapter 30	Lyapunov-based distributed MPC schemes: Sequential and iterative approaches MoLoIt-Liu [19]				
		Process			
System Type	Multiple Auton	omous Systems	Decomposed Monolithical System		
Process Type	Linear	Nonlinear	Hybrid		
Type of Model	Transfer	function	State Space		
Randomness	Detern	ninistic	Non-deterministic		
Type of Control	Regulation	Tracking	Economic		
Coupling Source	Const	raints	Objective		
	Input	Output	State		
	Co	ntrol Architectur	e		
Architecture	Decentralized	Distributed	Hierarchical		
Controller Knowledge	Strictly	/ Local	Partially Global		
Computation Type	Itera	ative	Non-iterative		
Controller Attitude	Coope	erative	Noncooperative		
Communication	Serial		Parallel		
Timing	Synchronous		Asynchronous		
Optimization Variables	Real		Integer		
Theoretical Properties					
Optimality	Ye	es	No		
<b>Suboptimality Bounds</b>	Ye	es	No		
Stability	Ye	es	No		
Robustness	Ye	es	No		
Chapter 31	Multi-layer decentralized MPC of large-scale networked systems MoGloNit-Oca [28]				
		Process			
System Type Process Type	Multiple Autor Linear	nomous Systems Nonlinear	Decomposed Monolithical System Hybrid		
T		c	00		

Chapter	Lyapunov-based distributed MPC schemes: Sequential and iterative
30	approaches MoLoIt-Liu [19]

31	MoGloNit-Oca [28]				
Process					
System Type	Multiple Autonomous Systems		Decomposed Monolithical System		
Process Type	Linear Nonlinear		Hybrid		
Type of Model	Transfer	function	State Space		
Randomness	Detern	ninistic	Non-deterministic		
Type of Control	Regulation	Tracking	Economic		
Coupling Source	Const	raints	Objective		
	Input	Output	State		
	Cont	trol Architecture			
Architecture	Decentralized	Distributed	Hierarchical		
Controller Knowledge	Strictly Local		Partially Global		
Computation Type	Iterative		Non-iterative		
<b>Controller Attitude</b>	Cooperative		Noncooperative		
Communication	Serial		Parallel		
Timing	Synchronous		Asynchronous		
<b>Optimization Variables</b>	Real		Integer		
Theoretical Properties					
Optimality	Ye	es	No		
Suboptimality Bounds	Yes		No		
Stability	Ye	es	No		
Robustness	Yes		No		

Chapter 32	Distributed MPC using reinforcement learning based negotiation: Application to large scale systems MoGloNit-Mor [23]			
	Process			
System Type	Multiple Autonomous Syster	ms Decomposed Monolithical System		
Process Type	Linear Nonlinear	Hybrid		
Type of Model	Transfer function	State Space		
Randomness	Deterministic	Non-deterministic		
Type of Control	Regulation Tracking	Economic		
Coupling Source	Constraints	Objective		
	Input Output	State		
	Control Architec	eture		
Architecture	Decentralized Distributed	Hierarchical		
Controller Knowledge	Strictly Local	Partially Global		
<b>Computation Type</b>	Iterative	Non-iterative		
<b>Controller Attitude</b>	Cooperative	Noncooperative		
Communication	Serial	Parallel		
Timing	Synchronous	Asynchronous		
<b>Optimization Variables</b>	Real	Integer		
	Theoretical Prop	erties		
Optimality	Yes	No		
Suboptimality Bounds	Yes	No		
Stability	Yes	No		
Robustness	Yes	No		
Chapter 33		ple commodity transportation networks GloNit-Nab [25]		
33 System Type	Mo	GloNit-Nab [25]		
33 System Type Process Type	Mo	GloNit-Nab [25] as Decomposed Monolithical System Hybrid		
33 System Type Process Type Type of Model	Mot Process Multiple Autonomous System	GloNit-Nab [25] as Decomposed Monolithical System Hybrid State Space		
33 System Type Process Type Type of Model Randomness	Mol Process Multiple Auto	GloNit-Nab [25] as Decomposed Monolithical System Hybrid State Space Non-deterministic		
33 System Type Process Type Type of Model Randomness Type of Control	Mod Process Multiple Auto=mous System Linear Nonlinear Transfer function Deter=inistic Regulation	GloNit-Nab [25] as Decomposed Monolithical System Hybrid State Space Non-deterministic Economic		
33 System Type Process Type Type of Model Randomness	Mod Process Multiple Autonomous System Linear Nonlinear Transfer function Deterministic Regulation Constraints	GloNit-Nab [25] as Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective		
33 System Type Process Type Type of Model Randomness Type of Control	Mod Process Multiple Auto-∞ous System Linear Nonlinear Transfer function Determistic Regulation Constraints Input Output	GloNit-Nab [25] as Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State		
33 System Type Process Type Type of Model Randomness Type of Control Coupling Source	Mod Process Multiple Auto-→ous System Linear Nonlinear Transfer function Deter→istic Regulation Constaints Input Output Control Archited	GloNit-Nab [25] as Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Cture		
33 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture	Mod Process Multiple Auto=>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	GloNit-Nab [25] as Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Cture Hierarchical		
33 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge	Mod Process Multiple Auto=>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	GloNit-Nab [25] as Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State ture Hierarchical Partially Global		
33 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type	Mod Process Multiple Auto=>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	GloNit-Nab [25]  As Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State ture Hierarchical Partially Global Non-iterative		
33 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude	Mod Process Multiple Auto=>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	GloNit-Nab [25]  As Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative		
33 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication	Hote       Multiple Auto=>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	GloNit-Nab [25]  As Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Hierarchical Partially Global Non-iterative Noncooperative Parallel		
33 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing	Hotel       Multiple Auto=>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	GloNit-Nab [25]  As Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State ture Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous		
33 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication	Hote       Multiple Auto->>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	GloNit-Nab [25]  As Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective State Cture Hierarchical Partially Global Non-iterative Parallel Asynchronous Integer		
33 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Hold         Multiple Auto         Multiple Auto         System         Innear       Nonlinear         Deterministic         Regulation         Control Archited         Input       Output         Deterministic         Input       Output         Deterministic       Iterative         Deterministic       Output         Control Archited       Strictve         Strictve       Local         Iterative       Iterative         Synchronus       Synchronus         Synchronus       Restender Strictve         Thewersteal Proper       Iterative	GloNit-Nab [25]  As Decomposed Monolithical System Hybrid State Space Non-deterministic Economic Objective Objective State Cture Hierarchical Partially Global Non-iterative Noncooperative Parallel Asynchronous Integer erties		
33 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Hote       Multiple Auto	GloNit-Nab [25]         as       Decomposed Monolithical System         Hybrid         State Space         Non-deterministic         Economic         Objective         Objective         State         Partially Global         Non-iterative         Noncooperative         Parallel         Asynchronous         Integer		
33 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables Optimality Suboptimality Bounds	Hote       Multiple Auto       Multiple Auto       System       Auto       Nonlinear       Nonlinear </th <th>GloNit-Nab [25]         as       Decomposed Monolithical System         Hybrid         State Space         Non-deterministic         Economic         Objective         Objective         State         Thierarchical         Partially Global         Non-iterative         Parallel         Asynchronous         Integer</th>	GloNit-Nab [25]         as       Decomposed Monolithical System         Hybrid         State Space         Non-deterministic         Economic         Objective         Objective         State         Thierarchical         Partially Global         Non-iterative         Parallel         Asynchronous         Integer		
33 System Type Process Type Type of Model Randomness Type of Control Coupling Source Architecture Controller Knowledge Computation Type Controller Attitude Communication Timing Optimization Variables	Hote       Multiple Auto	GloNit-Nab [25]         as       Decomposed Monolithical System         Hybrid         State Space         Non-deterministic         Economic         Objective         Objective         State         State         Objective         State         Objective         State         Objective         State         Objective         State         Vertice         Hierarchical         Partially Global         Non-iterative         Parallel         Asynchronous         Integer         erties         No		

Chapter 34	On the use of suboptimal solvers for efficient cooperative distributed linear MPC MoGloIt-Pan [29]				
		Process			
System Type	Multiple Auton	omous Systems	Decomposed Monolithical System		
Process Type	Linear	Nonlinear	Hybrid		
Type of Model	Transfer	function	State Space		
Randomness	Detern	ninistic	Non-deterministic		
Type of Control	Regulation	Tracking	Economic		
<b>Coupling Source</b>	Const	traints	Objective		
	Input	Output	State		
	Conti	ol Architecture			
Architecture	Decentralized	Distributed	Hierarchical		
Controller Knowledge	Strictly Local		Partially Global		
Computation Type	Iterative		Non-iterative		
<b>Controller Attitude</b>	Cooperative		Noncooperative		
Communication	Serial		Parallel		
Timing	Synchronous		Asynchronous		
<b>Optimization Variables</b>	Real		Integer		
Theoretical Properties					
Optimality	Yes		No		
Suboptimality Bounds	Yes		No		
Stability	Ye	es	No		
Robustness	Ye	es	No		

Chapter	Cooperative distributed MPC integrating a steady state target
35	optimizer MoGloIt-Fer [11]

Process					
System Type	Multiple Autonomous Systems		Decomposed Monolithical System		
Process Type	Linear	Nonlinear	Hybrid		
Type of Model	Transfer function		State Space		
Randomness	Detern	ninistic	Non-deterministic		
Type of Control	Regulation	Tracking	Economic		
Coupling Source	Const	raints	Objective		
	Input	Output	State		
	Contr	ol Architecture			
Architecture	Decentralized	Distributed	Hierarchical		
Controller Knowledge	Strictly	/ Local	Partially Global		
Computation Type	Iterative		Non-iterative		
Controller Attitude	Cooperative		Noncooperative		
Communication	Serial		Parallel		
Timing	Synchronous		Asynchronous		
<b>Optimization Variables</b>	Real		Integer		
Theoretical Properties					
Optimality	Yes		No		
Suboptimality Bounds	Yes		No		
Stability	Yes		No		
Robustness	Yes		No		

Chapter 36	Cooperative MPC with guaranteed exponential stability MoGloIt-Fer2 [10]				
Process					
System Type	Multiple Auton	omous Systems	Decomposed Monolithical System		
Process Type	Linear	Nonlinear	Hybrid		
Type of Model	Transfer	function	State Space		
Randomness	Detern	ninistic	Non-deterministic		
Type of Control	Regulation	Tracking	Economic		
Coupling Source	Const	raints	Objective		
	Input	Output	State		
	Contr	ol Architecture			
Architecture	Decentralized	Distributed	Hierarchical		
Controller Knowledge	Strictly	/ Local	Partially Global		
Computation Type	Itera	ative	Non-iterative		
<b>Controller Attitude</b>	Coope	erative	Noncooperative		
Communication	Se	rial	Parallel		
Timing	Synch	ronous	Asynchronous		
<b>Optimization Variables</b>	Re	eal	Integer		
Theoretical Properties					
Optimality	Ye	es	No		
Suboptimality Bounds	Ye	es	No		
Stability	Yes		No		
Robustness	Yes				

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