Mechanical Engineering Institute, USSR Academy of Science,
Ul Belinskogo, 85, 603024 Nizhny-Novgorod, USSR
Prof. B. Lundberg, Luleå
14–18 September 1992, Nizhny-Novgorod, USSR

296. *Real-gas effects in high-enthalpy flows*
Dr G. Eitelberg, Institute for Experimental Fluid Mechanics, DLR,
Bunsenstr. 10, D-3400 Göttingen, Germany
8–10 September 1992, Göttingen, Germany

297. *Fatigue analysis in the context of mechanical design*
Dr K. Dang Van, Laboratoire de Mécanique des Solides, Ecole
Polytechnique, F-91128 Palaiseau Cédex, France
31 August–4 September 1992, Lozari (Corsica), France

298. *Inelastic behaviour of structures under variable loads*
Prof. Z. Mroz, Polish Academy of Sciences, Institute of Fundamental
Technological Research, Swietokrzyska 21, P-00-049 Warsaw, Poland
Prof. D. Weichert, Lille, France
14–18 September 1992, Warsaw, Poland

Euromech Conferences are broad in scientific scope. They are open to all those interested and are expected to have a number of participants between 150 and 600. The general purpose is to provide opportunities for scientists and engineers from all parts of Europe to meet and discuss current research. The responsibility for each series of Conferences is delegated to a Standing Committee. The detailed organizational work is carried out by Local Organizing Committees (LOC). Those who are interested in taking part in one of the Conferences should write to the Chairman of the appropriate LOC. In 1992 there will be one Euromech Conference. Title, Chairman of the LOC, Dates and Location are given below.

4th European Turbulence Conference
Prof. F. T. M. Nieuwstadt, J. M. Burgers Centre for Fluid Dynamics,
Delft University of Technology, Rotterdamseweg 145, 2628 AL Delft,
The Netherlands
30 June–3 July 1992, Delft, The Netherlands

Buchbesprechungen – Book Reviews – Notices bibliographiques

A Course in Functional Analysis, 2nd Ed. Von John B. Conway (Springer-Verlag, Berlin 1990), 399 pp., DM148,–

Das vorliegende Buch ist vom Autor als Einführung in die (lineare) Funktionalanalysis gedacht. Conway setzt sowohl gute Kenntnisse der Mass- und Integrationstheorie, als auch der Topologie voraus. Ist dies erfüllt, so ist dieses Buch exzellent zum Selbststudium geeignet, da die einzelnen Kapitel durch viele Übungen ergänzt sind. Da das Buch eine grosse Vielfalt an Aspekten aufzeigt, und im Wesentlichen eigenständig ist, eignet es sich ebenfalls sehr gut als Nachschlagewerk.

Der Weg, welcher das Buch beschreitet beginnt beim Speziellen (Hilbertraum), um erst in späteren Kapiteln zu abstrakteren Konzepten (Banachraum, Lokal konvexer Vektorraum, C^*-Algebra, Spektraltheorie normaler (beschränkter) Operatoren, unbeschränkte Operatoren in Hilberträumen, Fredholmtheorie) vorzustossen. Die Zweitauflage des Buches unterscheidet sich im Wesentlichen von der ersten durch einen anderen, eleganteren Zugang zur Fredholmtheorie. Darüber hinaus wurden einige Fehler und Unklarheiten beseitigt; einige zum Teil interessante Aufgaben kamen dazu.

Dieses umfangreiche Werk deckt einen grossen Teil desjenigen ab, was man in der Funktionalanalysis braucht, und es werden darin einige interessante Anwendungen der Funktionalanalysis, wie zum Beispiel die Existenz des Haarmasses auf einer kompakten topologischen Gruppe, gegeben.

Meiner Meinung nach gibt es zu diesem Buch kaum Alternativen. Es kann jedem, der an Funktionalanalysis interessiert ist nur heiss empfohlen werden.

M. Koller, Zürich

Mathematical Modeling in Ecology—A Workbook for Students. By Clark Jeffries (Birkhäuser, Basel/Boston 1989), 189 pp., DM 62.–/sFr. 52.–

This book gives an introduction to the mathematical foundations of ecosystem modelling theory. It introduces the student to the study of deterministic ecosystem models associated with mathematical stability. Although simple models mostly of predator–prey type are presented, it deals mainly with abstract mathematics. Basic qualitative notions of dynamical systems theory are discussed. The mathematical level, however, is very low. A university student having attended introductory courses in calculus and linear algebra, as assumed by the authors, would be able to cope with a more mathematical language. In my opinion, a more mathematical style would shorten and simplify some of the contents of the book. The many misprints have to be mentioned, too, as well as the missing running heads.

In spite of this criticism this book is a valuable introduction to qualitative mathematical ecology. With numerous exercises and solutions, it can serve as a text-book for a course in ecosystem modelling.

A fundamental criticism to the field, however, is given by the author himself. In the final chapter he presents a realistic model for shortgrass prairie energy dynamics which does not exhibit the usual stability properties of the dynamical systems discussed before. While the summer period is a time of unstable and erratic energy flow bursts, the winter stabilizes the system by returning compartment levels to spring values. This model shows that the mathematical ecology as presented in this text is actually not very realistic.

K. Nipp, Applied Mathematics, ETH Zurich

Nonlinear Evolution Equations that Change Type. IMA Volumes in Mathematics and its Applications 27. By B. L. Keyfitz and M. Shearer (Eds.) (Springer-Verlag, New York 1990), 284 pp., 96 figs.; $35.–

This volume contains the proceedings of a conference held at the Institute for Mathematics and its Applications, University of Minnesota in March 1989 as part of a year of concentration on nonlinear waves.

Problems involving change of type arise in several fields of continuum mechanics, which are currently under active investigation. The topics discussed in the volume include viscoelastic flows, multiphase flows, granular flow and phase transitions in solids. Several papers in the volume are concerned with solutions of Riemann problems and admissibility of shocks for problems which change type. Other topics discussed include criteria for change of type in viscoelastic fluids, multiphase and granular flows, numerical simulation of non-Newtonian flows with change of type, development of singularities in viscoelastic flows, boundary conditions for supercritical viscoelastic flows, dynamics of shear flows of viscoelastic fluids with non-monotone constitutive laws, traveling wave solutions for phase transitions in a van der Waals fluid, problems of well-posedness and optimal control in models of shape memory alloys, and measure-valued solutions of a backward-forward heat equation.

The volume gives a good overview of current issues and interests in an important and active field of research.

Michael Renardy

Fundamentals of Measurable Dynamics: Ergodic Theory on Lebesgue Spaces. By D. J. Rudolph (Clarendon Press 1990), 184 pp.; £25.–

Loosely speaking, ergodic theory is the study of the 'long-term' behaviour of measure-preserving transformations under iteration. Basic questions are those of convergence theorems, recurrence properties, and classification. Quite often, the underlying probability space is assumed to be Lebesgue, i.e. metrically isomorphic to the unit interval together with Lebesgue measure. For such spaces the concepts of point homomorphism (mod 0) and homomorphism of measure algebras essentially coincides. This fact, among others, may serve as a hint that it is not unnaturally restrictive to consider Lebesgue spaces exclusively.

The book under consideration divides into two parts: An introduction to the ergodic theory of Lebesgue spaces (§§1–5), covering most of the classical examples and results, and a deeper investigation of the classification problem (§§6–7). It is this second part which makes this book unique. Once familiar with the techniques presented in the first part, the reader will come by a real treat: A unified approach to Krieger's Generator Theorem and Ornstein's Isomorphism Theorem. Up to now, both of these theorems have been considered 'too deep' to be included in an introductory text on ergodic theory. Moreover, the discovery of their deep connection should be of interest for specialists in the field as well.

Of course, there is a price you have to pay, when you want to reach the top of a current research field on 184 pages, starting off from real analysis. The point of view has to be very technical from the beginning, neglecting the significance of ergodic theory to applied sciences. The author is aware of this deficiency and recommends to read the first part of his book in conjunction with a more broadly oriented text. Let me complement his bibliographical references: *Ergodic Theory*, by K. Petersen (Cambridge University Press 1983).

Summing up, Rudolph's book will not necessarily turn you into an enthusiastic ergodic theorist, but if you are one, you certainly will not be willing to do without it anymore.

T. Bogenschütz, Bremen

Stabilization of Control Systems. By O. Hijab (Springer-Verlag, Berlin 1987) 129 p., 3 Figs., DM 76,–

As it is correctly stated in the introduction the purpose of the book is to present an exposition of mathematical tools needed in order to deal with the following "uncertain" variant of the classical control problem: Design an output-feedback-law which stabilizes a linear control system

$$\dot{x} = Ax + Bu, \quad y = Cx. \tag{1}$$

The "uncertainty" is twofold: (i) White noise is added to the output equation in the usual way. (ii) The information about the dynamics of the input/output behavior is comprised in these statements:

$$(A, B, C) \in \{(A_\theta, B_\theta, C_\theta),: \theta \in \{1, \ldots, N\} \text{ a random variable,}\}$$
$$x(0) \in \{x_\theta^{(0)}\}. \tag{2}$$

Hence the information concerning (1) which is available for the implementation of a control strategy is the conditional expectation of θ given the values of $y(t)$ up to some time T. The design objective ("stabilization") of course has then to be understood in the probabilistic sense: The statement $x(t) \to 0$ für $t \to \infty$ should be true with probability 1.

Two proposals for effective stabilization are made in Chapter 5. As it appears to the referee the first one (Theorem 5.3.1) has to do with robust rather than stochastic adaptive stabilization and can be understood without the probabilistic machinery. It amounts to the requirement that all deterministic systems which serve as samples (2) of the underlying stochastic system can *simultaneously* be stabilized by *static* output feedback. The second group of results revolves around Theorem 5.4.5 and is of different stature concerning the amount of probability theory involved. The method mimics the well known approach to the (deterministic) stabilization problem via the (infinite horizon) LQR-problem. In order to get a quick impression of this method one should try to read sections 1, 3, 5 of Chapter 5 before a systematic study of the book. As is the case with the mere stabilization problem also one concrete solution to the optimization problem is offered. The conditions however which have to be imposed on the data (2) are restrictive and not at all generic (see (A1) and (A2) on p. 95).

The book is meant for use as a text. Whether it serves this purpose and for which kind of audience it does is difficult to assess. Obviously the author has tried to make the presentation self-contained by extensively (80% of the whole volume!) reviewing material from standard linear control theory (Chapter 1, 2), stochastic differential equations (Chapter 3), filtering (Chapter 4). Most of the 120 problems (solutions are given in the appendix) are chosen in order to improve the reader's understanding of concepts from these areas. For this reason the book could be used as an additional reference when teaching control theory to mathematicians. The referee however does not agree with the author's opinion that the book could fill a gap ("... in a clear and concise fashion ...", p. x) in the existing literature on linear control theory. The mathematical background which is displayed elsewhere is here and there more satisfactory, the treatment of the Riccati-equation in Chapter 3 is one of quite a few instances where this happens.

The referee would also hesitate to recommend the book as main mathematical source when preparing a course for engineers. With a trivial exception (Section 1 in Chapter 1) there is a complete absence of examples which bear a relation to something like "real world". The unbalance between the high level of mathematical prerequisites on one side and the meager offer of non-academic examples on the other side is in particular felt in Chapter 5. As soon as one steps off the restrictive frame which we have indicated above one sees onself encountered with the problem: How to find a mathematical model which meets the hypotheses of the theory? Almost nothing is contributed to the crucial problem of mathematical modelling. The "learning" capacity of the controller, i.e. acquisition of information about the random variable θ in the course of the time is touched upon in the probabilistic and therefore static context (cf. p. 65 and Sec. 3, Chapter 5) only. In short: Redoing standard linear control theory in a probabilistic setting does not provide a comprehensive picture of adaptive control as a whole. H. W. Knobloch

Matched Asymptotic Expansions—Ideas and Techniques, Appl. Math. Sciences, Vol. 76. By P. A. Lagerstrom (Springer-Verlag, Berlin 1988), 250 pp., 8 figs.; DM 78,–

This book deals with layer-type problems in differential equations, mainly singularly perturbed two-point boundary value problems. Chapter I gives an introduction to well-known notions and concepts of singular perturbation theory. Those concepts were first introduced by S. Kaplun in the mid-fifties and partly extended later by P. A. Lagerstrom and others. In Chapter II singularly perturbed model boundary value problems of ordinary differential equations are treated by the method of matched asymptotic expansions. Chapter III discusses a few simpler problems from partial differential equations.

Although most of the content has been known for quite some time the book puts things together in a nice way, and it provides an interesting collection of model problems which may be treated by the method of matched asymptotic expansions. Of course, this monograph has to be compared to similar ones in the field. Although the present volume is rather related to the one by Kevorkian and Cole in the same Springer Series (Vol. 34, 1981), it is more strongly based on the concept of matching.

K. Nipp, Applied Mathematics, ETH Zurich

Convexity Methods in Hamiltonian Mechanics. By I. Ekeland (Springer-Verlag, Berlin 1990) 265 pp., 4 figs; DM 148.–

This book deals with periodic solutions of Hamiltonian systems whose Hamiltonian is convex. It is addressed to mathematicians despite its title. It is a well conceived and written book. And, although rather specialized, it might be read by non specialists. It is an account on recent results obtained by Ekeland as well as some of Ambrosetti, Clarke, Hofer, Rabinowitz and others.

The book is divided into five chapters. The first one deals with linear Hamiltonian systems and presents nicely index theory. Krein theory as well as Ekeland's work on this subject are exposed.

The second chapter recalls classical facts from convex analysis (in a rather complex form) similar to those in the books of the author with Témam or with Aubin. It contains also a presentation of the duality principle introduced by Clarke for Hamiltonian systems.

Chapter III and IV deal with fixed period problems. The first one is concerned with the sublinear case (i.e. with subquadratic Hamiltonian) while the second one deals with the more difficult superlinear case (i.e. with superquadratic Hamiltonian).

Finally Chapter V is concerned with fixed energy problems. It is an even more difficult problem than the preceding ones. It gives some existence and multiplicity results. It closes with some open questions.

B. Dacorogna

Algebraische Geometrie, eine Einführung. Von M. Brodmann (Birkhäuser Verlag, Basel 1989), 488 S., SFr. 88.–

Das Buch ist auf Grund einer, an der Universität gehaltenen, Vorlesung entstanden. Der Autor erwartet vom Leser eine Grundausbildung von 2 bis 3 Studiensemestern. Insbesondere werden keine grossen Kenntnisse der Algebra vorausgesetzt, und die benötigten algebraischen Hilfsmittel werden geschickt nach Bedarf eingeführt.

Obwohl recht umfangreich, bleibt das Buch angenehm zu lesen. Es enthält viele Beispiele, hat lehrreiche Bilder, und der Autor macht laufend treffende Bemerkungen. Alle Abschnitte werden durch Übungen ergänzt.

Das erste Kapitel ist sehr elementar und gibt eine gute Idee der algebraischen Geometrie. Die wichtigsten Begriffe werden beim einfachen Fall der affinen Hyperflächen eingeführt. Die weiteren Kapitel heissen: Affine Varietäten, endliche Morphismen und Dimension, Tangentialraum und Multiplizität, projektive Varietäten, Garben.

Das Werk konzentriert sich auf einige zentrale Begriffe wie regulärer und singulärer Punkt, Tangentialkegel, Multiplizität, Dimension. Ausführlich werden auch die Morphismen, d.h. die Abbildungen der algebraischen Geometrie, behandelt. Es ist als Einführung in die fortgeschrittene Literatur bestens geeignet und kann sowohl Studenten empfohlen werden, als auch Mathematikern, welche es als Nachschlagwerk benützen können.

M.-A. Knus

Numerical Methods for Conservation Laws. By R. J. Le Veque (Birkhäuser, Basel/Boston 1990), 214 pp.; DM44.–

These lecture notes were developed from a graduate course taught at the University of Washington in Seattle and at ETH Zurich. They provide an excellent introduction to the mathematical field of conservation laws which are nonlinear hyperbolic partial differential equations typically involving shock waves. Part I of the book deals with the theoretical background for the understanding of the mathematical structure of these equations and their solutions. Examples such as the traffic flow and applications such as the Euler equations of gas dynamics are discussed. Part II deals with numerical methods for conservation laws. Various classes of schemes are discussed. Particular attention is given to computing discontinuous solutions. The aim is the development of 'high resolution methods' which are accurate on smooth parts of a solution and yet give well resolved, nonoscillatory shocks. Concepts of local and global error, convergence and stability are also discussed to quite some extent.

This book is a very good introductory text for students and those who wish to become acquainted with the interesting and important topic of conservation laws and its numerical treatment.

K. Nipp, Applied Mathematics, ETH Zürich