III European Conference on Computational Mechanics
Solids, Structures and Coupled Problems in Engineering
C.A. Mota Soares et al. (eds.)
Lisbon, Portugal, 5–8 June 2006

Multiscale Strategy for Solving Industrial Problems

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ABSTRACT

Multi-scale strategies are now mature for most of linear spatial problem. They can also be applied as solver in the case of non-linear problem but it is our opinion that more robust and efficient methods can be designed in that case. Two examples will serve as illustration. The case of crack propagation [1] and the case of post-buckling analyses of aeronautical structures [2].
In [3] Ladevèze proposed a multi-scale strategy for solving non-linear problem. This method offers several possibilities to adapt it in order that the main difficulties of the problem are specifically treated. One of its appealing features is to split the macro part from the micro one at interface level only. This allow to work on the most adapted splitting of the interfacial quantities. The classical choice which allows to incorporate homogenization at the macro-level automatically is the one where the interfacial macro extractor is associated with the linear part.
In the case of crack propagation it appears more adapted to introduce a discontinuous scheme at the macro level, the use of the PUM method [4] for crack allows improving the micro description of the solution.
In the case of the post-buckling analysis of large aeronautical, the non-linear scheme used, allows to iterate where it is needed only, that is in the sub-structures prone to the highest degree of non-linearity. As non-linearities are often localized (i. e; corresponds to a local buckling giving rise to large displacement of the whole structure) the computational effort can be reduced drastically in comparison with a classical [2].

References

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