



The Integrated Computational Environment for Mathematical Modelling

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ABSTRACT

The conception, architecture, numerical and technological approaches of the integrated computational environment (ICE) for mathematical modelling is described. The mathematical tasks to be solved present the direct and inverse interdisciplinary problems, which are described by the systems of partial differential and/or integral equations in the multi-dimensional computational domains with real complicated multiscale geometry and contrast material properties. The numerical efficiency of the ICE is provided by the advanced approximation on the adaptive quasi-structured grids and by high performance, algebraic algorithms based on the domain decomposition methods in the Krylov subspaces. The scalable parallelism is obtained by means of the hybrid programming on the heterogeneous multi-processor clusters with distributed and hierarchical shared memory. The conception of the ICE consists in developing the instrumental media to support all the main stages of large-scale computational experiments (geometric and functional modelling, grid generation, approximation of the original equations, solving the numerical algebra problems, etc.), with a long life cycle of the products. The technical requirements for the ICE include the flexible extension of the mathematical models and methods, the adaption to evolution of the computer platforms, reusing the external program product, and coordinated participation in the project of the different groups of developers. The objectives of technological tools consist in automatic construction of algorithms as well as generating and executing the applied software packages for the end users in particular domains.



Universidad Politécnica de Madrid
E.T.S. de Arquitectura,
Departamento de Matemática Aplicada

International Conference Challenges in Mathematical Architecture.
Theory, Modelling and Applications
<http://ccma2019.aq.upm.es>

CCMA2019 is a satellite conference of ICIAM 2019 - Valencia