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Editorial

Preface to the special issue on modeling error estimation and adaptive modeling in computational mechanics

This special issue is concerned with methods for modeling error estimation and adaptive modeling and collects contributions on this topic from a wide range of applications pertaining to Computational Mechanics. The idea of editing such a special issue was actually instigated by the success of the mini-symposium entitled "Adaptive Modeling in Computational Mechanics" that took place at the 8th World Congress on Computational Mechanics and 5th European Congress on Computational Methods in Applied Sciences and Engineering, Venice, Italy, June 30–July 4, 2008. The special issue contains eleven original research articles written by authors who were invited to participate in the mini-symposium.

A continued trend in computational sciences and engineering is to tackle larger and larger problems that involve increasingly more complex mathematical models. Solution methods for such large problems are definitely in need for robust and accurate algorithms, which can be provided by error estimation and adaptive strategies. In recent years, the field of adaptive methods for computational mechanics has expanded to include adaptive modeling, which goes beyond the usual steps of mesh refinement and involves refining the mathematical models themselves. The concept of adaptive modeling can be simply described as that concerned with assessing and controlling the accuracy of surrogate mathematical models with respect to their reference or base models, such as in model reduction techniques and multiscale methods.

This special issue represents to date an invaluable collection of papers on the subject of adaptive modeling, dealing either with

modeling error estimation, combined modeling and discretization error control, goal-oriented model adaptivity, or hierarchical and reduction methods, and with applications in linear elasticity, heterogeneous structures and materials, atomic-to-continuum bridging and multiscale methods, electrocardiology, fluid–structure interactions, turbulent fluid flows, etc.

More importantly, we would like to thank the authors for writing excellent research articles and for being so patient all along the preparation of this special issue. Needless to say that we are extremely satisfied with the final product. We also strongly believe that these contributions clearly outline the wide range of applications that this research field encompasses and that they will help advance the current state-of-the-art and define new directions for future work.

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