Invited Lecture

ON THE ISSUE OF MULTISCALE ROBUSTNESS IN COMPUTATIONAL MECHANICS

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Abstract:

In the present paper the new definition of the *multiscale robustness* in computational mechanics is proposed in order to support theoretical settings of multiscale analysis, that is bridging of simulation on atomistic scale with simulation on the scale of continuum mechanics, and vice versa. In addition, procedure for its evaluation is explained in detail. Namely, there is a growing need to develop systematic modeling and simulation approaches for multiscale and multimaterials model problems in order to provide the accurate data about the state of stress, defect structure, thermal and mechanical performance of the subregions with different geometric scales. The issue of multiscale robustness is elaborated on the example of original primal mixed finite element approach in solid mechanics which is successfully bridged with molecular dynamics on atomistic level, where transient heat transfer is semi-coupled with elastostatics. The approach is full scale, three-dimensional in geometry, physical lows and constitutive relations. The comparative studies with abundantly used displacement based finite element approach are provided also.

Key words: Computational mechanics, finite element, multiscale, multifield, coupled, atomistic, continuum mechanics

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