16th World Congress on Computational Mechanics and 4th Pan American Congress on Computational Mechanics

July 21-26, 2024, Vancouver Convention Centre, Vancouver, British Columbia, Canada

VERIFICATION TECHNIQUES IN COMPUTATIONAL PHYSICS AND APPLIED MATHEMATICS

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In computational mathematics and physics codes, verification and validation of the implementation and suitability of the governing equations are necessary to develop confidence in the credibility of the simulations. Verification assesses the accuracy of the numerical solutions the code produces, relative to the assumptions and expectations associated with the numerical methods.

Verification can be divided into code verification and solution verification. Code verification focuses on the correctness of the numerical-method implementation in the code (numerical-error evaluation), whereas solution verification focuses on numerical-error estimation for simulations that do not have an exact solution available. Spatial and temporal discretization are often the primary focus of code verification and are typically checked using manufactured and/or exact solutions and grid/time-refinement studies. On the other hand, grid/time-refinement studies are not the only techniques proposed in the literature to address error estimation. However, most (if not all) of the proposed techniques require data in the so-called 'asymptotic range'. Such a requirement makes solution verification troublesome in practical calculations.

Topics of interest include manufactured solutions, exact solutions, and other code-verification techniques, as well as error-estimation (solution-verification) techniques, for computational physics and applied mathematics codes.