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

EFFICIENT ITERATIVE METHODS FOR SOLVING COUPLED AND STRONGLY NONLINEAR PROBLEMS

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MINISYMPOSIUM

Strongly nonlinear and coupled problems, such as multiphysics problems, play a vital role across many applications in physics and engineering. The nonlinearity in such problems generally arises from the coupling between scales across physical properties, spatial and temporal scales. Due to these reasons, the resulting nonlinear system of equations often tends to be nonlinear, non-convex, non-smooth, and highly ill-conditioned. In such cases, developing or employing efficient and robust iterative methods becomes essential. In general, the robustness and the efficiency of the iterative methods, either monolithic or alternate minimization schemes, are improved by exploiting the structure/physics of the underlying problem. In general, such iterative methods have to be tailored to the specific problem types.
This mini-symposia aims to address the active research, discuss the current state-of-the-art methods in these domains, highlight emerging trends, and address problem-specific practical considerations in developing such iterative schemes. We seek contributions related to enhancing alternate and monolithic schemes, with particular focus on (but not limited to):
- Linear and nonlinear preconditioning strategies
- Field-split and domain-decomposition methods
- Multilevel/multiscale methods
- Acceleration techniques
- Novel ways of enforcing coupling,
- Efficient implementation, e.g., matrix-free methodologies, architectured-based implementation.

We are particularly interested in problem-specific design of iterative methods/approaches with applications from the various fields of computational mechanics, including contact mechanics, fracture mechanics, fluid-structure interactions, coupled flow in porous media, and interface problems.