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

THE PHASE FIELD METHOD FOR FRACTURE: THEORY, NUMERICS, AND APPLICATIONS

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Pioneered by Francfort and Marigo, the phase-field theory avoids the tracking of mobile sharp crack surfaces, replacing the otherwise implied boundary conditions with a partial differential equation that governs the evolution of time- and space-dependent functions (phase-field). The governing equation of the phase field is devised to guarantee that the motion of the diffused interfacial region complies with the prescribed physical laws, e.g., Griffith's brittle fracture theory. In this sense, the phase-field theory indeed serves as a regularized mathematical interface, which incorporates the complex sharp crack surface into a spatially smooth continuum scheme and facilitates finite-element-based numerical implementations in a straightforward manner. In addition to the theory's successful application to classical mechanical problems, e.g., composite delamination, functionally graded materials, rock fracture, large strain fracture of polymer, and interfacial fracture of concrete, the theory has been extended to many multi-physics problems, including hydrogen embrittlement, cement hydration, stress corrosion, Li insertion, coupled fluid–structure fracture, and polymer oxidative aging, etc.

We organize this symposium to discuss recent progress in various aspects of the PFM for fracture. Topics of interest include (but not limit to):

1. Phase-field model for fracture in multi-physical problems
2. High-performance computing strategies for phase field approach
3. Multi-scale modeling involving the phase field approach
4. Complex fracture problems by the phase field approach
5. Engineering computing and application of phase field approaches