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PHASE FIELD MODELS IN ENGINEERING

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ABSTRACT

The phase field method has emerged as a versatile and interdisciplinary modeling framework with growing relevance across all branches of engineering. By describing complex interface-evolution phenomena - such as fracture, damage, corrosion and phase transformation - through a continuous field variable, this approach enables the simulation of processes that traditionally required separate modeling strategies. Its thermodynamically consistent formulation and compatibility with the finite element method have made it an increasingly practical tool for solving real engineering problems.

In recent years, phase field models have been successfully applied to a wide range of engineering challenges: brittle and ductile fracture, fatigue crack growth, corrosion and oxidation in energy systems, and hydrogen-induced degradation in infrastructures. This unified framework facilitates the development of interdisciplinary physical models that reflect the true multiphysics nature of engineering materials.

This thematic session focuses on the use of the phase field method to model and define physical problems in engineering. It aims to highlight applications of the phase field framework to fracture and material damage, corrosion, and other degradation or transformation phenomena—either as standalone physical processes or within fully coupled multiphysics environments. Both application-oriented and fundamental contributions are welcome, covering theoretical developments, numerical implementations, and practical case studies.