

# **A unified variational eigen-erosion framework for interacting fracture and compaction band in brittle porous media**

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## **Abstract**

The onset and propagation of the cracks and compaction bands, and the interactions between them in the host matrix, are important for numerous engineering applications, such as hydraulic fracture and CO<sub>2</sub> storage. While crack may become flow conduit that leads to leakage, formation of compaction band often accompanies significant porosity reduction that prevents fluid to flow through. The objective of this paper is to present a new unified framework that predicts both the onset, propagation and interactions among cracks and compaction bands via an eigen-deformation approach. By extending the generalized Griffin's theory, we formulate a unified nonlocal scheme that is capable to predict the fluid-driven fracture and compression-driven anti-crack growth while incorporating the cubic law to replicate the induced anisotropic permeability changes triggered by crack and anti-crack growth. The proposed model is verified against a benchmark problem and a set of numerical experiments are used to demonstrate the robustness and efficiency of the proposed model.