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# An alternative Elastoplastic Model for Ductile Fracture with graded plasticity

Clémence Pham<sup>\*1</sup>, Habibou Maitournam<sup>2</sup>, Claude Stolz<sup>2</sup>, Darius Seyedi<sup>3</sup>, and Cédric Gourdin<sup>3</sup>

<sup>1</sup>Université Paris-Saclay, CEA, Service d'Etudes Mécaniques et Thermiques, 91191 Gif-Sur-Yvette – Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA) - Saclay – France

<sup>2</sup>Institut des Sciences de la Mécanique et Applications Industrielles – IMSIA - UMR EDF/CNRS/CEA/ENSTA 9219, ENSTA Paris, Institut Polytechnique de Paris – France

<sup>3</sup>Université Paris-Saclay, CEA, Service d'Etudes Mécaniques et Thermiques, 91191 Gif-Sur-Yvette – Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA) - Saclay – France

## Abstract

The prediction of failure modes in metallic structures is a crucial step in the safety analysis of industrial components subjected to significant mechanical loads (e.g., nuclear power plant components, pipelines, etc.). To perform such analyses, it is essential to accurately simulate the propagation of a defect in the ductile regime, characterized by large plastic deformations before and during propagation.

Predictive numerical simulation of ductile fracture remains an open scientific and technical challenge, despite significant progress in recent years. The so-called local approach to fracture is widely used to model ductile fracture; however, like all softening models, it exhibits dependency on spatial discretization.

The objective of this work is to propose a robust approach for modeling and simulating ductile fracture at the structural scale. It introduces an elastoplastic model with a bounded gradient of accumulated plastic strain and an associated set of internal constraints. This method aims to eliminate mesh dependency, without increasing the number of degrees of freedom of the numerical problem as it can be the case for most of non-local models. So, the proposed model strives for fast and efficient numerical computations at the structural scale. The feasibility of this approach is demonstrated through the resolution of problems on simple geometries, such as cylinders or spheres made of composite elastoplastic materials. Tests on 316L steel specimens are also conducted to further validate the robustness of this method.

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\*Speaker