



Document details - A phase-field model for ductile fracture with shear bands: A parallel implementation

1 of 1

[Export](#) [Download](#) [More...](#)

International Journal of Mechanical Sciences
Volume 200, 15 June 2021, Article number 106424

A phase-field model for ductile fracture with shear bands: A parallel implementation(Article)

Samaniego, C., Ulloa, J., Rodríguez, P., Houzeaux, G., Vázquez, M., Samaniego, E.

^aBarcelona Supercomputing Center (BSC-CNS), Nexus II Building, Jordi Girona 29, Barcelona, 08034, Spain

^bDepartment of Civil Engineering, KU Leuven, Kasteelpark Arenberg 40, Leuven, B-3001, Belgium

^cChair of Computational Science and Simulation Technology, Department of Mathematics and Physics, Leibniz Universität Hannover, Appelstraße 11, Hannover, 30167, Germany

[View additional affiliations](#)

Abstract

Modeling complex material failure with competing mechanisms is a difficult task that often leads to mathematical and numerical challenges. This work contributes to the study of localized failure mechanisms by means of phase fields in a variational framework: in addition to the treatment of brittle and ductile fracture, done in previous work, we consider the case of shear band formation followed by ductile fracture. To achieve this, a new degradation function is introduced, which distinguishes between two successive failure mechanisms: (i) plastic strain localization and (ii) ductile fracture. Specifically, the onset of elastic damage is delayed to allow for the formation of shear bands driven by plastic deformations, thus accounting for the mechanisms that precede the coalescence of voids and microcracks into macroscopic ductile fractures. Once a critical degradation value has been reached, a phase-field model is introduced to capture the (regularized) kinematics of macroscopic cracks. To tackle the issue of potentially high computational cost, we propose a parallel implementation of the phase-field approach based on an iterative algorithm. The algorithm was implemented within the Alya system, a high performance computational mechanics code. Several examples show the capabilities of our implementation. We pay special attention to the ability to capture different failure mechanisms. © 2021 Elsevier Ltd

SciVal Topic Prominence

Topic: Phase Field | Quasistatic Evolution | Brittle Fracture

Prominence percentile: 98.456

Author keywords

[Ductile fracture](#) [Parallel implementation](#) [Phase-field](#) [Shear band](#)

Funding details

Funding sponsor	Funding number	Acronym
CYTED Ciencia y Tecnología para el Desarrollo	P515RT0031	CYTED

Funding text

We gratefully acknowledge the financial support of CYTED P515RT0031 project (Ibero-American Program to Promote Science and Technology) through the CADING network (Ibero-American Network for High Performance Computing in Engineering). The support of the EU H2020-MSCA-RISE-2016 project BESTOFRAF: Environmentally best practices and optimisation in hydraulic fracturing for shale gas/oil development is also acknowledged.

Cited by 2 documents

Ulloa, J. , Wambacq, J. , Alessi, R.
A micromechanics-based variational phase-field model for fracture in geomaterials with brittle-tensile and compressive-ductile behavior

(2022) *Journal of the Mechanics and Physics of Solids*

Zhang, Y. , Ren, H. , Areias, P.

Quasi-static and dynamic fracture modeling by the nonlocal operator method

(2021) *Engineering Analysis with Boundary Elements*

[View details of all 2 citations](#)

Inform me when this document is cited in Scopus:


[Set citation alert](#) >

[Set citation feed](#) >

Related documents

Find more related documents in Scopus based on:

[Authors](#) > [Keywords](#) >

 Samaniego, C.; Barcelona Supercomputing Center (BSC-CNS), Nexus II Building, Jordi Girona 29, Barcelona, Spain;

© Copyright 2021 Elsevier B.V., All rights reserved.

About Scopus

[What is Scopus](#)

[Content coverage](#)

[Scopus blog](#)

[Scopus API](#)

[Privacy matters](#)

Language

[日本語に切り替える](#)

[切换到简体中文](#)

[切换到繁體中文](#)

[Русский язык](#)

Customer Service

[Help](#)

[Tutorials](#)

[Contact us](#)

ELSEVIER

[Terms and conditions](#) ↗ [Privacy policy](#) ↗

Copyright © Elsevier B.V. ↗. All rights reserved. Scopus® is a registered trademark of Elsevier B.V.

We use cookies to help provide and enhance our service and tailor content. By continuing, you agree to the use of cookies.

