

Accepted Manuscript

A phase-field approach embedded in the Theory of Porous Media for the description of dynamic hydraulic fracturing, Part II: The crack-opening indicator

Wolfgang Ehlers, Chenyi Luo



PII: S0045-7825(18)30337-2
DOI: <https://doi.org/10.1016/j.cma.2018.07.006>
Reference: CMA 11978

To appear in: *Comput. Methods Appl. Mech. Engrg.*

Received date: 8 March 2018
Revised date: 25 June 2018
Accepted date: 2 July 2018

Please cite this article as: W. Ehlers, C. Luo, A phase-field approach embedded in the Theory of Porous Media for the description of dynamic hydraulic fracturing, Part II: The crack-opening indicator, *Comput. Methods Appl. Mech. Engrg.* (2018), <https://doi.org/10.1016/j.cma.2018.07.006>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

1
2
3
4 1 A phase-field approach embedded in the Theory of Porous Media
5 2 for the description of dynamic hydraulic fracturing
6
7 3 Part II: The crack-opening indicator
8
9

10 4 Wolfgang Ehlers*, Chenyi Luo

11 5 *Institute of Applied Mechanics (CE), University of Stuttgart, Pfaffenwaldring 7, 70569, Stuttgart, Germany*
12
13
14
15
16

17 6 **Abstract**

18 7 The well-known phase-field approach applied to fracturing solids has recently been embedded in
19 8 the Theory of Porous Media for the description of hydraulic fracturing scenarios. This method has
20 9 been found very convenient not only for the description of solid deformation and fracture but also
21 10 for the transition of Darcy-type flow in the saturated porous-media domain towards Navier-Stokes-
22 11 type flow in fractured zones. However, as a result of the monotonic evolution of the phase-field
23 12 variable, the phase-field approach to fracture does not usually allow for the description of pre-
24 13 existing closed fractures or of fractures closing after generation, where either only Darcy-type
25 14 flow occurs or where Navier-Stokes-type flow turns back to Darcy-type flow. To tackle this issue,
26 15 the present study concerns the introduction of a crack-opening indicator as an additional variable
27 16 governed by the current deformation. By use of this procedure, not only opening but also closing
28 17 fractures as well as pre-fractured domains can easily be included into the numerical simulation
29 18 of fracking scenarios in saturated porous media. Proceeding from the finite-element analysis, the
30 19 numerical results are found consistent with experimental observations presented in the literature.

31 20 *Keywords:* Hydraulic fracturing; Phase-field approach; Theory of Porous Media; Pre-existing
32 21 cracks; Crack-opening indicator.
33
34
35
36
37
38
39
40
41
42
43
44

45 52 *Corresponding author. Fax: +49 711 685 66347.

46 53 *Email addresses:* Wolfgang.Ehlers@mechbau.uni-stuttgart.de (Wolfgang Ehlers),
47 54 Chenyi.Luo@mechbau.uni-stuttgart.de (Chenyi Luo)
48
49
50
51

Download English Version:

<https://daneshyari.com/en/article/6915275>

Download Persian Version:

<https://daneshyari.com/article/6915275>

[Daneshyari.com](https://daneshyari.com)