

**Ortiz, M.; Pandolfi, A.**

**Finite-deformation irreversible cohesive elements for three-dimensional crack propagation analysis.** (English) [Zbl 0932.74067](#)

*Int. J. Numer. Methods Eng.* 44, No. 9, 1267-1282 (1999).

**Summary:** We develop a three-dimensional finite-deformation cohesive element and a class of irreversible cohesive laws which enable an accurate and efficient tracking of dynamically growing cracks. The cohesive element governs the separation of the crack flanks in accordance with an irreversible cohesive law, eventually leading to the formation of free surfaces, and is compatible with a conventional finite element discretization of the bulk material. The versatility and predictive ability of the method is demonstrated through the simulation of a drop-weight dynamic fracture test. The ability of the method to approximate the experimentally observed crack-tip trajectory is particularly noteworthy.

**MSC:**

[74S05](#) Finite element methods applied to problems in solid mechanics  
[74R20](#) Anelastic fracture and damage

Cited in **1** Review  
Cited in **201** Documents

**Keywords:**

[irreversible cohesive law](#); [drop-weight dynamic fracture test](#); [crack-tip trajectory](#)

**Full Text:** [DOI](#)

**References:**

- [1] Zehnder, *Int. J. Fracture* 43 pp 271– (1990)
- [2] Mathur, *J. Mech. Phys. Solids* 44 pp 439– (1996)
- [3] Marusich, *Int. J. Numer. Meth. Engng.* 38 pp 3675– (1995)
- [4] Dugdale, *J. Mech. Phys. Solids* 8 pp 100– (1960)
- [5] Barrenblatt, *Adv. Appl. Mech.* 7 pp 55– (1962)
- [6] ?Mathematical analysis in the mechanics of fracture?, in (ed.), *Fracture*, Academic Press, New York, 1968, pp. 191-311.
- [7] Camacho, *Int. J. Solids Struct.* 33 pp 2899– (1996)
- [8] Ravichandar, *Int. J. Fracture* 26 pp 141– (1984)
- [9] Liu, *Int. J. Fracture* (1997)
- [10] Rose, *Phys. Rev. Lett.* 47 pp 675– (1981)
- [11] Needleman, *J. Appl. Mech.* 54 pp 525– (1987)
- [12] Ortiz, *Int. J. Solids Struct.* 24 pp 231– (1988)
- [13] and ?Book chapter: dislocation nucleation versus cleavage decohesion at crack tips?, in and (eds.), *Modeling the Deformation of Crystalline Solids: Physical Theory, Application and Experimental Comparisons*, Warrendale, PA, 1991, TSM-AIME, pp. 457-480.
- [14] Rice, *J. Mech. Phys. Solids* 40 pp 235– (1992)
- [15] Ortiz, *J. Appl. Mech.* 60 pp 77– (1993)
- [16] Needleman, *Ultramicroscopy* 40 pp 203– (1992)
- [17] Hillerborg, *Cement Concrete Resarch* 6 pp 773– (1976)
- [18] *Mechanical Damage and Crack Growth in Concrete*, Martinus Nijhoff, Dordrecht, The Netherlands, 1986. · [doi:10.1007/978-94-009-4350-6](#)
- [19] Needleman, *Int. J. Fracture* 42 pp 21– (1990)
- [20] Xu, *Int. J. Numer. Meth. Engng.* 36 pp 3675– (1993)
- [21] and ?Book chapter: cohesive cracks as a solution of a class of nonlocal problems?, in (ed.), *Fracture and Damage in Quasibrittle Structures. Experiment, modelling and Computer analysis*, E & FN SPON, 1994.
- [22] Tvergaard, *J. Mech. Phys. Solids* 41 pp 1119– (1993)

- [23] Tvergaard, J. *Physique IV* 6 pp 165– (1996) · doi:10.1051/jp4:1996616
- [24] Tvergaard, *Int. J. Solids and Struct.* 33 pp 3297– (1996)
- [25] ?Simulation issues of distributed and localized failure computations?, in and (eds.), *Cracking and Damage*, Elsevier Science, New York, 1989, pp. 363-378.
- [26] Xu, J. *Mech. Phys. Solids* 42 pp 1397– (1994)
- [27] Xu, *Int. J. Fracture* 74 pp 253– (1995) · doi:10.1007/BF00033830
- [28] Xu, *Int. J. Fracture* 74 pp 289– (1996)
- [29] De-Andrés, *IJSS* (1998)
- [30] and *Mathematical foundations of elasticity*, Prentice-Hall, Englewood Cliffs, N.J., 1983.
- [31] Lubliner, *Int. J. Non-Linear Mech.* 7 pp 237– (1972)
- [32] Lubliner, *Acta Mechanica* 17 pp 109– (1973)
- [33] Chen, J. *Physique IV* 4 pp 177– (1994)
- [34] Chen, J. *Am. Ceramic Soc.* 79 pp 579– (1996)
- [35] ?An overview of semidiscretization and time integration procedures?, in and (eds.), *Computational Methods for Transient Analysis*, North-Holland, Amsterdam, 1983, pp. 1-65.
- [36] ?Analysis of transient algorithms with particular reference to stability behavior?, in and (eds.), *Computational Methods for Transient Analysis*, North-Holland, Amsterdam, 1983, pp. 67-155.
- [37] Cuitiño, *Engng. Comput.* 9 pp 437– (1992)
- [38] Camacho, *Comput. Meth. Appl. Mech. Engng.* 142 pp 269– (1997)

This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.