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**A new fast finite element method for dislocations based on interior discontinuities.** (English)

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Summary: A new technique for the modelling of multiple dislocations based on introducing interior discontinuities is presented. In contrast to existing methods, the superposition of infinite domain solutions is avoided; interior discontinuities are specified on the dislocation slip surfaces and the resulting boundary value problem is solved by a finite element method. The accuracy of the proposed method is verified and its efficiency for multi-dislocation problems is illustrated. Bounded core energies are incorporated into the method through regularization of the discontinuities at their edges. Though the method is applied to edge dislocations here, its extension to other types of dislocations is straightforward.

**MSC:**

74S05 Finite element methods applied to problems in solid mechanics

Cited in **23** Documents

**Keywords:**

dislocations; extended finite element method

**Software:**

XFEM

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**References:**

- [1] Belytschko, International Journal for Numerical Methods in Engineering 45 pp 601– (1999)
- [2] Moës, International Journal for Numerical Methods in Engineering 46 pp 131– (1999)
- [3] Belytschko, International Journal for Numerical Methods in Engineering 50 pp 993– (2001)
- [4] van der Giessen, Modelling Simulation in Material Science and Engineering 3 pp 689– (1995)
- [5] Amodeo, Physical Review B 41 pp 6958– (1990)
- [6] Schwarz, Applied Physics Letters 69 pp 1220– (1996)
- [7] Canova, Solid State Phenomena 35–36 pp 101– (1993)
- [8] Zbib, International Journal of Mechanical Sciences 40 pp 113– (1998)
- [9] Devincere, Material Science and Engineering A309–310 pp 211– (2001)
- [10] Lemarchand, Journal of the Mechanics and Physics of Solids 49 pp 1969– (2001)
- [11] Sukumar, International Journal for Numerical Methods in Engineering 48 pp 1549– (2000)
- [12] Moës, Engineering Fracture Mechanics 69 pp 813– (2002)
- [13] Song, International Journal for Numerical Methods in Engineering 67 pp 868– (2006)
- [14] Sukumar, Computer Methods in Applied Mechanics and Engineering 190 pp 6183– (2001)
- [15] Chessa, Journal of Applied Mechanics–Transactions of the 70 pp 10– (2003)
- [16] Xiao, International Journal for Numerical Methods in Engineering 66 pp 1378– (2006)
- [17] Legay, International Journal for Numerical Methods in Engineering 64 pp 991– (2005)
- [18] Laborde, International Journal for Numerical Methods in Engineering 64 pp 354– (2005)
- [19] Rethore, International Journal for Numerical Methods in Engineering 64 pp 260– (2005)
- [20] Areias, International Journal for Numerical Methods in Engineering 63 pp 760– (2005)
- [21] Legrain, International Journal for Numerical Methods in Engineering 63 pp 290– (2005)
- [22] Larsson, International Journal for Numerical Methods in Engineering 62 pp 1763– (2005)
- [23] Areias, International Journal for Numerical Methods in Engineering 66 pp 878– (2006)
- [24] Samaniego, International Journal for Numerical Methods in Engineering 62 pp 1857– (2005)
- [25] Volterra, Annales Scientifiques de l'cole Normale Suprieure Sr. 3 24 pp 401– (1907)

- [26] Eshelby, *Philosophical Transactions of the Royal Society of London. Series A, Mathematical and Physical Sciences* 244 pp 87– (1951)
- [27] Ventura, *International Journal for Numerical Methods in Engineering* 62 pp 1463– (2005)
- [28] Melenk, *Computer Methods in Applied Mechanics and Engineering* 139 pp 290– (1996)
- [29] Ventura, *International Journal for Numerical Methods in Engineering* 66 pp 761– (2006)
- [30] Stazi, *Computational Mechanics* 31 pp 38– (2003)
- [31] . *Theory of Dislocations*, vol. 1 (2nd edn). Wiley: New York, 1982.
- [32] Head, *Proceedings of the Physical Society, Section B* 66 pp 793– (1953)

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