Crack dynamics in a bimaterial lattice

Andrea Piccolroaz[1], Nikolai Gorbushin[2], Gennady Mishuris[2]
[1] *Dipartimento di Ingegneria Meccanica e Strutturale, Universit di Trento, Trento, Italy*
E-mail:roaz@ing.unitn.it

[2] *Institute of Mathematical and Physical Sciences, Aberystwyth University, Aberystwyth, U.K.*
E-mail:gorbushinnikolay@gmail.com,ggm@aber.ac.uk

Keywords: bimaterial lattice; crack propagation; Wiener-Hopf method

We consider an infinite rectangular bimaterial lattice with interface links having different properties than those of the adjacent structures. A semi-infinite crack propagates along the interface generating waves. We construct the dispersion diagrams, analysing possible waves propagating in the bimaterial structure. The propagation of the crack is induced by an external load generating feeding waves which bring energy to the crack front bonds and cause their disintegration. In turn, this produces dissipative waves which carry energy away from the crack front. Using the approach of Slepyan [1], an equation of the Wiener-Hopf type is derived and solved along the crack face. The crack stability is analysed via the evaluation of the energy release rate for different contrasts in the properties of the glued structures. Using this model, we present numerical illustrations showing the effect of mismatch in properties of lattices and also the effect of the introduced interface. Admissible and forbidden regimes are identified on the basis of the assumed fracture criterion [2].

Acknowledgements. A.P. gratefully acknowledges financial support from ERC-2013-ADG-3405-61-INSTABILITIES. N.G. gratefully acknowledges financial support from the European Unions Seventh Framework Programme FP7/2007-2013/ under REA grant agreement number PITN-GA-2013-606878-CERMAT2. G.M. gratefully acknowledges financial support from the European Unions Seventh Framework Programme FP7/2007-2013/ under REA grant agreement number IRSES-GA-2013-610547-TAMER.

References

[1] *Slepyan, L.I. "Feeding and dissipative waves in fracture and phase transition. III. Triangular-cell lattice," J. Mech. Phys. Solids* **49***, 2839-2875, (2001).*

[2] *Gorbushin, N., Mishuris, G., "On admissible steady-state regimes of crack propagation in a square-cell lattice.," arXiv:1701.04818 [physics.class-ph] (2017).*