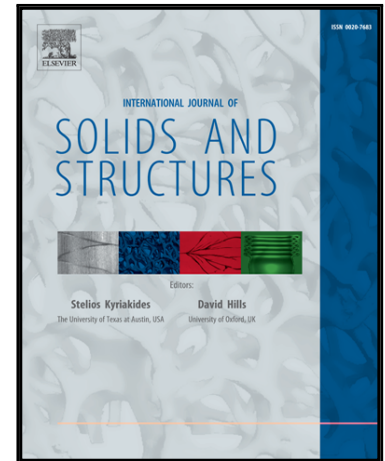


## Accepted Manuscript

Interaction of cracks with dislocations in couple-stress elasticity. Part II: Shear modes

K.P. Baxevanakis , P.A. Gourgiotis , H.G. Georgiadis

PII: S0020-7683(17)30130-0  
DOI: [10.1016/j.ijsolstr.2017.03.021](https://doi.org/10.1016/j.ijsolstr.2017.03.021)  
Reference: SAS 9510



To appear in: *International Journal of Solids and Structures*

Received date: 27 December 2016  
Revised date: 13 March 2017  
Accepted date: 18 March 2017

Please cite this article as: K.P. Baxevanakis , P.A. Gourgiotis , H.G. Georgiadis , Interaction of cracks with dislocations in couple-stress elasticity. Part II: Shear modes, *International Journal of Solids and Structures* (2017), doi: [10.1016/j.ijsolstr.2017.03.021](https://doi.org/10.1016/j.ijsolstr.2017.03.021)

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.

# Interaction of cracks with dislocations in couple-stress elasticity.

## Part II: Shear modes

K.P. Baxevanakis<sup>1\*</sup>, P.A. Gourgiotis<sup>2</sup>, H.G. Georgiadis<sup>1\*\*</sup>

<sup>1</sup>*Mechanics Division, National Technical University of Athens, Zographou, GR-15773, Greece*

<sup>2</sup>*School of Engineering & Computing Sciences, Durham University, South Road, Durham,  
DH1 3LE, UK*

**Abstract:** In the second part of this study, the interaction of a finite-length crack with a glide and a screw dislocation is examined within the framework of couple-stress elasticity. The loading from the two defects on the crack results to plane and antiplane shear modes of fracture, respectively. Both problems are attacked using the distributed dislocation technique and the cracks are modeled using distributions of discrete glide or screw dislocations. The antiplane strain case is governed by a single hyper-singular integral equation with a cubic singularity, whereas the plane strain case by a singular integral equation. In both cases, the integral equations are numerically solved using appropriate collocation techniques. The results obtained herein show that a crack under antiplane conditions closes in a smoother way as compared to the classical elasticity result. Further, the evaluation of the energy release rate in the crack tips reveals an ‘alternating’ behavior between strengthening and weakening effects in the plane strain case, depending on the defect’s distance from the crack tip and the magnitude of the characteristic material length. On the other hand, the energy release rate in the antiplane mode shows a strengthening effect when couple-stresses are considered.

**Keywords:** Screw Dislocation; Glide Dislocation; Microstructure; Hyper-singular Integral Equations; couple-stress theory.

---

\* Current affiliation: Theoretical & Applied Mechanics Group, Mechanical Engineering & Mechanics Department, Drexel University, 3141 Chestnut Street, Philadelphia, PA 19104, USA.

\*\* Corresponding author: H.G. Georgiadis. *E-mail* address: [georgiad@central.ntua.gr](mailto:georgiad@central.ntua.gr)

Download English Version:

<https://daneshyari.com/en/article/4922458>

Download Persian Version:

<https://daneshyari.com/article/4922458>

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