Weak Solutions to the Boundary Value Problems of Plane Cosserat Elasticity

ELENA SHMOYLOVA, STANISLAV POTAPENKO*, AND LEO ROTHENBURG

Department of Civil Engineering
University of Waterloo
Waterloo, Ontario, N2L 3G1, Canada
* spotapen@civmail.uwaterloo.ca

In this presentation we discuss the application of boundary-integral equation method to the solution of boundary-value problems of plane linear theory of elasticity with microstructure (Cosserat Elasticity). Analytical solutions of boundary value problems of plane Cosserat elasticity have been obtained in the form of integral potentials in L^2 space. However, in L^2 such solutions can be found only if the boundary is sufficiently smooth and cannot be obtained in the case of the reduced boundary smoothness or if the domain contains cracks. To obtain solutions for the domain with an irregular boundary we can formulate the boundary value problems of plane Cosserat elasticity in a Sobolev space and find the corresponding weak solutions. In addition, this approach facilitates the close monitoring of the performance of numerical schemes in domains with relatively low degree of smoothness.

We discuss applications of the afore-mentioned theory leading to the problems of stress concentrations around a crack in a human bone and in rock mechanics.

Keywords: microstructure, weak solutions