ME Seminar

Boundary integral formulations for addressing some special problems in linearized elasticity

Dr. Salil S. Kulkarni, Professor, Department of Mechanical Engineering, IIT Bombay

ABSTRACT

The Boundary Integral Equation Method is one of the several techniques that is used to solve problems in linear elasticity. It is the method of choice when dealing with problems which have large amount of hard inclusions embedded in an elastic matrix. Boundary integral formulations which lead to integral equations of the second kind are especially useful as on discretization they lead to well conditioned system of equations. This talk presents such formulations for the following four types of problems: 1. resistivity problem 2. mobility problem 3. expansion problem and 4. inverse expansion problem. In problems 1 and 3, the displacement is prescribed on the boundaries on the inclusions and the goal is to obtain the net torque and force acting on the inclusions. In problems 2 and 4, the net force and torque acting on the inclusions are given and the goal is to find the corresponding displacement of the inclusions. Various two-dimensional problems are considered to demonstrate the utility of the proposed formulations. It is observed that the accuracy of the developed formulations is not only comparable to that of the usual direct Boundary Element Method but also that the solutions are obtained at reduced computational cost. It is felt that the proposed formulations can be used in various current research areas including deformation control of soft material using embedded hard magnetic particles and phase change driven composite materials.

ABOUT THE SPEAKER

Salil S. Kulkarni is a faculty member in the Department of Mechanical Engineering at IIT Bombay. He received his B.E. degree from College of Engineering, Pune, M.E. degree from Indian Institute of Science, Bangalore and his Ph.D. degree from Cornell University, Ithaca. He is interested in computational mechanics with focus on developing methods which reduce the computational efforts.

7th January 2026, 2:30 PM, MMCR, Department of Mechanical Engineering, IISc