

CNDE Webinar Presentation

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This webinar will be recorded and made available on the CNDE website



Analytical Solutions for Crack Propagation and Diffraction of Plane Waves by a Rigid Strip

Presented by:

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Abstract:

The study of crack propagation and wave diffraction in materials is essential for understanding structural integrity and failure mechanisms. This webinar will present analytical solutions for two critical phenomena: crack propagation in anisotropic materials and the diffraction of plane waves by a rigid strip. In the first part, the focus will be on crack propagation in monoclinic crystalline layers, where the interaction between elastic waves and cracks is studied under mechanical point loading. The formulation of this model involves coupled singular integral equations, from which the stress intensity factor (SIF) at the crack tip is derived. The effects of crack length, punch pressure, and anisotropy are explored through numerical simulations, revealing how these parameters influence crack behavior and structural stability. In the second part of this presentation, we will discuss the diffraction of magnetoelastic plane waves by a rigid strip in a reinforced infinite medium. The analytical model is solved using integral equations, yields closed-form expressions for vertical displacement and normal stress. The dependence of diffraction patterns on parameters such as magnetoelastic coupling, wave number, and material anisotropy is examined, providing insights into wave behavior in different material media. This presentation will highlight the challenges and contributions of these studies, showcasing their relevance in the fields of solid mechanics, fracture analysis, and non-destructive evaluation (NDE) techniques.

Speaker:

Dr. Pulkit Kumar is a Research Scientist II at the Center for Nondestructive Evaluation (CNDE), Iowa State University, USA. He holds a Ph.D. in Applied Mathematics from IIT (ISM) Dhanbad, India. His research focuses on wave propagation, solid mechanics, elastodynamics, and nondestructive evaluation (NDE), with specific applications in composite materials. Dr. Kumar has also gained postdoctoral experience, having worked as a Postdoctoral Research Associate in the Center for Nondestructive Evaluation (CNDE) at Iowa State University (ISU) from 2023 to 2024. Prior to this, he served as an Assistant Professor at Siksha 'O' Anusandhan University, India and as a Postdoctoral Research Fellow at IIT Delhi. Dr. Kumar has authored 19 SCI journal papers, contributed to several conference proceedings, and has a growing citation index of 246, with an h-index of 11. He is proficient in software such as ABAQUS, Mathematica, and MATLAB. His ongoing projects include ultrasonic testing (UT) characterization of complex microstructures of titanium alloys, Model-Assisted POD, and NDE modeling of ceramic matrix composites. He is also a life member of several scientific societies and serves as a reviewer for more than 17 journals. With a focus on advancing NDE techniques, his work continues to bridge the gap between theoretical modeling and experimental validation, addressing critical challenges in aerospace, automotive, and electronic applications.

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