



THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

SEMINAR ON APPLIED MATHEMATICS

**Elastic Wave Imaging via Kirchhoff Migration:
Resolution Analysis and Inclusion Identification**

By

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Abstract

We consider the inverse problem of determining the location, orientation, shape, and material parameters of a small elastic inclusion embedded in a homogeneous medium from full-aperture measurements of the scattered field. Using a small-volume expansion, we derive explicit leading-order expressions for four Kirchhoff migration imaging functionals, denoted by PP, PS, SP, and SS, corresponding to the four combinations of pressure (P) and shear (S) waves used for receiver- and source-side backpropagation. The resulting point-spread functions quantitatively characterize the resolution of each mode and show that the SS mode achieves the highest spatial resolution. For an elliptic inclusion, we show that the PP mode uniquely determines the elastic moment tensor (EMT) within the leading-order asymptotic model, thereby enabling the reconstruction of the material and geometric parameters of the inclusion. For a general small scatterer, the reconstruction may instead be interpreted as an effective elliptic representation determined by its leading-order EMT. For a disk, the parameter-identification problem is underdetermined; nevertheless, explicit up-per and lower bounds on its volume are derived. We further analyze the model error arising from neglected cross-mode contributions when the distance from the center of the measurement configuration is not sufficiently large relative to the elastic wavelengths. Numerical experiments support the theoretical predictions and demonstrate the effectiveness of the proposed imaging and reconstruction methods. This talk is based on joint work with Prof. Josselin Garnier.

Date : 6 November 2026 (Friday)

***Time : 2:00p.m.-3:00p.m.**

***Venue : Room 5508 (near Lift 25/26)**

All are Welcome!