MAE Seminar SERIES

Thursday, September 19

3:30 PM

Knox 14

Dr. Ankit Srivastava

Associate Professor (Ph.D.)

Mechanical, Materials, and Aerospace Engineering

IIT Chicago

Spectral Properties of Elastodynamic Eigenvalue Problems in the Phononic Context

ABSTRACT

In this talk, I consider the operator properties of various phononic eigenvalue problems. The aim is to answer some fundamental questions about the eigenvalues and eigenvectors of phononic operators. These include questions about the potential real and complex nature of the eigenvalues, whether the eigenvectors form a complete basis, what are the right orthogonality relationships, and how to create a complete basis when none may exist at the outset. In doing so I present a unified understanding of the properties of the phononic eigenvalues and eigenvectors which would emerge from any numerical method employed to compute such quantities. I show that the phononic problem can be cast into linear eigenvalue forms from which such quantities as frequencies, wavenumbers, and desired components of wavevectors can be directly ascertained without resorting to searches or quadratic eigenvalue problems and that the relevant properties of such quantities can be determined apriori through the analysis of the associated operators. I also show how the Plane Wave Expansion (PWE) method may be extended to solve each of these eigenvalue forms, thus extending the applicability of the PWE method to cases beyond those which have been considered till now. The theoretical discussions are supplemented with supporting numerical calculations. The techniques and results presented here directly apply to wave propagation in other systems such as waveguides and photonics. These ideas are also connected, more generally, to nonhermitian physics, some repercussions of which will be discussed in the context of exceptional and diabolic points in the spectrum.

BIO SKETCH

Dr. Ankit Srivastava is an Associate Professor in the Mechanical, Materials, and Aerospace Engineering department at the Illinois Institute of Technology in Chicago. He has an M.S. and a PhD in Structural Engineering from the University of California San Diego (UCSD). He worked with Prof. Sia Nemat-Nasser in the Mechanical and Aerospace Engineering department at UCSD as a postdoctoral researcher in the areas of phononics, metamaterials, and dynamic homogenization. He has received the NSF Career award and is on the editorial board of Mechanics of Materials. His current research interests are varied and, in the phononics and metamaterials areas, concern underlying fundamental problems relating to causality, homogenization, and operator physics.

University at Buffalo
Department of Mechanical and Aerospace Engineering
School of Engineering and Applied Sciences