

Research Statement

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My dissertation research focused on crystallographic texture of sheet metals. When metal sheets are manufactured, the rolling action imparts a preferred orientation to the crystallites, or grains, in the material. This preferred orientation can be represented as an infinite series of generalized spherical functions. Typically, a small number of the coefficients involved in this infinite series dominate the descriptions of material properties of the metal. I developed a method to model two dominant coefficients as functions of depth through the thickness using data obtained from a nondestructive measurement technique involving electromagnetic acoustic transducers. This project involved partial differential equations, perturbation theory, resonance measurements, and x-ray diffraction. I chose this particular project was because I was interested in nondestructive evaluation of material properties and wanted to increase my ability to collaborate with experimentalists by learning more about experimental methods.

My immediate research interest involves understanding the implications of stress distributions on cracking in ceramics. An associated concern is the exploration of microstructure (crystallographic texture, misorientation, grain size, grain geometry, etc.) on deformation and failure mechanisms of ceramics.

My long term interests lie in mathematical inverse problems derived from the physical world. I intend to approach problems with an open mind, without expectations of proving specific theorems or advancing one branch of mathematics; of course, applied problems sometimes lead to these mathematical results. Before any equations can be written, the existing scientific knowledge of the physical system must be understood. Once the problem is narrowed down, many types of math may be necessary to attack it. To be effective, an applied mathematician must have knowledge of as many different tools as possible. To build my toolbox, I have developed some understanding of numerical differential equations and numerical linear algebra, real analysis, differential geometry, and partial differential equations. I hope to develop more skills in algebra, topology, and complex analysis, and assimilate the basics of combinatorics, optimization, coding and information theory, and graph theory.

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