

Honoring Professor Erdogan's Seminal Contributions to Mixed Boundary-Value Problems of Inhomogeneous and Functionally Graded Materials

Foreword

Professor Fazil Erdogan has influenced several generations of applied and solid mechanics working in the area of mixed boundary-value problems of inhomogeneous media, most notably fracture and contact problems. The analytical approaches that he had developed with his students in the 1960s and 1970s for the formulation and reduction of fracture mechanics problems involving layered media to systems of singular integral equations, and the corresponding solution techniques, have motivated researchers working in this area throughout the entire world. His subsequent work on fracture mechanics problems of inhomogeneous media with smoothly varying elastic moduli has laid the foundation for applying these techniques to functionally graded materials, which played key roles in many technologically important applications (e.g., spatially tailored structures for the new generation of hypersonic aircraft, graded cementitious composites for sustainable infrastructure, high-performance graded components for automobiles, and graded microtools in mechatronics). Professor Erdogan's continuing leadership role and ceaseless contributions to the fracture and contact mechanics of this new generation of materials provide guidance and motivation for others to follow. This special issue honors Professor Erdogan in recognition of his past and continuing contributions in the area that plays a critical role in the development of engineered material systems for critical technological applications, and builds upon a minisymposium under the above title held at the recent International Conference on Multiscale and Functionally Graded Materials (M&FGM2006) on Oct. 15–18, 2006, Honolulu, HI.

The special issue is comprised of 13 invited papers containing original, previously unpublished contributions in the mechanics of inhomogeneous and functionally graded materials. The invited contributors, including Professor Erdogan who has provided with Dr. Ozturk (coauthor) the lead article summarizing the various types of singularities that may be encountered in contact and fracture mechanics, include selected authors of presentations given at the above conference. Some of these contributors are Professor Erdogan's ex-students and past or present collaborators, while others are distinguished researchers working in this topical area who did not attend the conference. Analytical, computational, experimental, and theoretical aspects of the mechanics of inhomogeneous media in the broad sense, and functionally graded mate-

rials, in particular, are covered by the 13 papers. Topics range from the fundamental aspects of crack propagation in graded materials, construction of elasticity solutions for layered anisotropic media, development of novel computational procedures, and specific problems of technological importance involving graded coatings and cover plates to micromechanics-based calculations involving periodically layered media and functionally graded particulate materials. Examination of the contributed articles reveals the need for a multipronged approach in the modeling and simulation of graded and layered materials, and the important role that locally exact analytical solutions may play in the development of new computational procedures.

Many of us who have been influenced directly or indirectly by Professor Erdogan's work hope that this will be a lasting issue in an area that continues to grow vigorously. One of the coeditors of this special issue (M.-J. P) recalls his first contact with the work of Professor Erdogan while collaborating some 25 years ago with Dr. Sailon Chatterjee at the Materials Sciences Corporation on fracture mechanics of layered anisotropic materials. "The techniques to which I was being introduced in the course of conducting research on defect criticality of composite laminates for the Naval Air Development Center were based on Professor Erdogan's now classical papers, and Sailon often telephoned *Fazil*, who he called his secret weapon, for clarification or guidance to ensure that we were on the right path. It took me a while to realize that this mysterious *Fazil* was in fact Professor Erdogan whose papers and guidance enabled us to prosper."

We are indeed grateful that we were given the opportunity to assemble this special issue in order to honor Professor Fazil Erdogan. He continues to be a source of inspiration to the mechanics community in leading the way in the area of mixed boundary-value problems in inhomogeneous and functionally graded media and also in providing selfless guidance to others.

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