Foreword

Professor Fazil Erdogan has influenced several generations of applied and solid mechanicians 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 infrastructure, high-performance graded components for autonomous and grades 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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