Warner T. Koiter Medal

Richard D. James
Russell J. Penrose Professor, the University of Minnesota

For pioneering the modern vision of phase transformations and materials instabilities in solids.

Professor Richard D. James received a Sc.B. in Engineering from Brown University in 1974, and Ph.D. in Mechanical Engineering from the Johns Hopkins University in 1979. He was appointed as Research Fellow at the University of Minnesota in 1979, and Assistant Professor at Brown University in 1981. In 1985, he joined the faculty of the University of Minnesota, where he is now the Russell J. Penrose Professor.

Professor James has pioneered new directions in the mechanics of active materials, introducing fundamentally new concepts and techniques and has used the insights of theoretical analysis to develop new materials. He has proved mathematical theorems but, at the same time, has set-up fine experiments.

He initiated the study of the nonuniqueness of nonclassical shock waves (in his context he was working with phase boundaries). Continuing this work, in his 1995 paper with Abeyaratne and Chu,
'Kinetics with wiggly energies', James discusses the difficulties of using this approach in experimentally observable situations involving fine scale microstructure. So he approached hysteresis from a very different point of view, that of metastability. This work revealed a significant and previously unrecognized connection between hysteresis and compatibility: roughly transformations between two solid phases that are kinematically compatible can proceed with very low hysteresis.

His most influential contribution is fine-scale solutions in phase transformation problems. His paper in Archives for Rational Mechanics Analysis (1987) with John Ball departs from classical solutions in solid mechanics as it demonstrates that a homogeneous hyperelastic solid subjected to homogenous boundary conditions can spontaneously respond with fine-scale oscillations in the deformation gradient, interpreted as the formation of a microstructure. It made connections with the (geometric) crystallographic theory of martensite and to previous linear theories. It provided a rational foundation for the phenomenological theory.

Professor James is active in serving the community of mechanics. He is the Chief Editor (with John Ball) of the Archive for Rational Mechanics and Analysis, and is on the board of a number of journals. He has served on the National Science Foundation Advisory Groups on 'Future Directions in Solid Mechanics'.

Professor James is a Fellow of the American Academy of Mechanics. He has received the George Taylor Distinguished Research Award, form the Institute of Technology at the University

of Minnesota, the Rothschild Visiting Professor ship from the University of Cambridge, and the Alexander von Humboldt Senior Research Award.

The Warner T. Koiter Medal, established in 1996, is bestowed in recognition of distinguished contributions to the field of solid mechanics with special emphasis on the effective blending of theoretical and applied elements of the discipline, and on a high degree of leadership in the international solid mechanics community.