

## Daniel C. Drucker Medal



**James R. Barber**

*Arthur F. Thurnau Professor of Mechanical Engineering and Applied Mechanics, Professor of Civil and Environmental Engineering  
The University of Michigan in Ann Arbor*

***For seminal contributions in the areas of frictionally excited thermo-elastic instabilities, contact and indentation problems, brittle fracture, elastodynamics and elasticity, and for distinguished academic contributions as educator, book author and high quality scholarly researcher***

**Professor James R. Barber** studied Mechanical Sciences at Cambridge University 1960-1963 and then joined British Rail in the Chief Mechanical Engineer's Department. In 1965, British Rail sponsored his return to Cambridge as a research student, where he worked on the subject of thermal effects in braking systems, obtaining the Ph.D. in 1968. In 1969 he became Lecturer and later Reader in Solid Mechanics at the University of Newcastle upon Tyne, England. In 1981 he moved to the University of Michigan, where he is presently Arthur F. Thurnau Professor of Mechanical Engineering and Applied Mechanics and Professor of Civil and Environmental Engineering.

Much of Prof. Barber's research is concerned with the mechanics of contact between deformable bodies, to which he has made numerous and substantial contributions in fields as diverse as thermoelastic contact, the effect of surface roughness, the Coulomb friction law, electrical contact resistance, and impact. A striking feature of his work is that it spans the range from rigorous and elegant proofs of general theorems in mechanics to the development of solutions and methods that are of direct and immediate use in industry. He has a talent for exposing the underlying structure of a complex problem in simple physical and mathematical terms and his papers are widely regarded as being of exemplary clarity and precision.

Prof. Barber is particularly well known for his investigations of problems in which contact pressure is influenced by thermoelastic deformation resulting from frictional heat generation at the interface or from heat flow across it. He discovered the phenomenon now known as TEI (frictionally-excited thermoelastic instability) leading to hot spots in (for example) brakes and clutches. His work extends from his initial validation of this explanation of experimentally observed hot spots, to the development of a finite element description of the stability problem that predicts the sliding speed at the onset of instability and the corresponding eigenmode for practical brake or clutch designs.

Real surfaces are inevitably rough and the macroscopic boundary conditions observed or assumed in 'smooth' contact problems must be interpreted as some kind of regularization. Prof. Barber's recent contributions include studies of the effect of scale refinement on the solution of the contact problem, with a view to establishing quantities that approach limits as the scale is reduced without limit. Approaching the same problem from a different perspective, he was able to establish rigorous bounds on the incremental stiffness in an elastic contact problem. The same methodology provides bounds on the electrical resistance of a contact interface.

Prof. Barber has also made numerous contributions to the classical linear theory of elasticity, including the extension of the two-dimensional complex variable solution to the development of exact solutions to three-dimensional solutions for the prismatic bar loaded on its lateral surfaces. His book 'Elasticity' is used as a textbook worldwide.

**The Daniel C. Drucker Medal was established in 1997 and is conferred in recognition of distinguished contributions to the field of applied mechanics and mechanical engineering through research, teaching and service to the community over a substantial period of time.**