Journal of Applied Mechanics

Memoriam

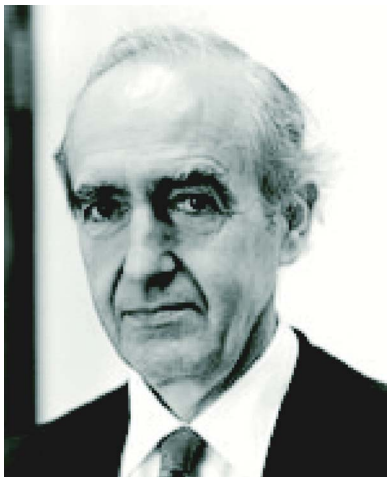
In Memoriam: Erastus H. Lee

Erastus H. Lee, professor emeritus of Stanford University and RPI, and a prominent researcher, with fundamental contributions to plasticity, viscoelasticity and wave propagation, died at the age of 90 on May 17, 2006 in Lee, New Hampshire.

Ras Lee was born on February 2, 1916, in Southport, England. He graduated from Cambridge University in 1937 with a First Class Honours degree in mechanical sciences and mathematics. After a year of postgraduate study at Cambridge with Professor C. E. Inglis, Ras was awarded a fellowship from the Commonwealth Fund of New York to study with Professor Stephen P. Timoshenko at Stanford University. There he met Shirley, and later completed his Ph.D. and married her, both in 1940. Immediately thereafter, he became involved in the British war effort. He worked first as a progress officer in the British Purchasing Commission in New York and later in the British Air Commission in Washington. Ras was responsible for planning aircraft deliveries from U.S. companies and for specifying modifications required to meet British needs. He and Shirley returned to England during the war, where Ras first worked at the Ordnance Board and then at the Ministry of Supply Armament Research Department. He was elected a Fellow of his College, Gonville and Caius, Cambridge, in 1944, and became Assistant Director in charge of the Technical Engineering Section of the Production Department of the newly established British Atomic Energy Authority in 1946.

After an offer from Professor William Prager, Lee and his family returned to the United States in 1948, where he was a Professor of Applied Mathematics at Brown University for 14 years. He served as Chairman of the Applied Mathematics Division for five years. During these years, faculty members in the Divisions of Applied Mathematics and Engineering, which included Dan Drucker, Harry Kolsky, Allen Pipkin, Paul Symonds, Ronald Rivlin, Dick Shield, and Eli Sternberg in addition to Prager and Lee, made Brown the worldwide center for research in solid mechanics. In 1962, Ras was appointed as a Professor in the Division of Applied Mechanics and the Department of Aeronautics and Astronautics at Stanford University, joining Norman Goodier, Wilhelm Flügge, Nick Hoff, and Miklos Hetenyi in the widely acclaimed Stanford applied mechanics group. Almost every graduate student in solid mechanics during that time took Lee's sequence of three courses (each two quarters long) in nonlinear continuum mechanics, viscoelasticity, and plasticity. He remained at Stanford for 20 years (1962–1982), taking mandatory retirement at the age of 65. For the last 10 years of his professional career, Ras was the Rosalind and John J. Redfern, Jr. Chair Professor of Engineering at Rensselaer Polytechnic Institute.

In his early work, Lee made fundamental contributions to the development of solutions for elastic-plastic problems and slip-line methods for metal forming processes. This includes a series of papers, written in England with R. Hill and S. J. Tupper, on the theory of the autofrettage process, wedge indentation in ductile metals, and compression of a block between rough plates. This was followed by research with his students at Brown on the stress discontinuities in plane plastic flow, the analysis of plastic flow in deeply notched bars, and discontinuous machining and chip formation. At Brown, Lee also made significant contributions to the analysis of boundary value problems in the theory of plastic wave propagation, including the determination of moving plastic-elastic boundaries, known as loading and unloading waves, with particular application to normal impact between a cylinder and rigid target at rest. Extending his research interests to polymers, he contributed significantly to the development of solution methods for viscoelastic stress analysis, by reducing them to more tractable elasticity problems, which is now known as the correspondence principle. He studied the effects of residual stresses and temperature variations on viscoelastic response (the well-known time-temperature shift), viscoelastic contact problems, and viscoelastic wave propagation. His research papers in this field are regularly referenced in contemporary publications, monographs, and books devoted to viscoelasticity.



Erastus H. Lee
February 2, 1916–May 17, 2006

Lee continued his research on inelastic wave propagation at Stanford, by developing a finite-strain elastic-plastic theory with application to plane-wave analysis, as arises in dynamic plate impact problems, which culminated in his 1969 paper "Elastic-Plastic Deformation at Finite Strain," published in the *Journal of Applied Mechanics*. Through this research, he developed a framework for the constitutive analysis of large elastic-plastic deformations based on the multiplicative decomposition of the deformation gradient ($F=FeFp$), now commonly referred to as Lee's decomposition. This decomposition had a great impact on subsequent developments of elastoplastic constitutive theories for polycrystalline materials and single crystals. With his students at Stanford and RPI, Lee applied his decomposition to develop rate-type theories of elastoplastic deformation at finite strain for both isotropic and anisotropic materials. His other contributions to mechanics include studies of shock waves in elastic-plastic solids,

wave propagation in composite materials with periodic structure, elastic-plastic stress and deformation analysis of metal-forming processes, providing the first calculations of residual stresses, and the modeling of anisotropic strain hardening.

Lee was elected to the National Academy of Engineering in 1975 and was awarded the Timoshenko Medal in 1976, in recognition of his distinguished contributions to the field of applied mechanics. He was a Fellow of the American Academy of Mechanics, and a Life Fellow of the American Society of Mechanical Engineers, with frequent publications in the *Journal of Applied Mechanics* throughout his career. With contributions from his colleagues and former students, an anniversary volume, entitled *Topics in Plasticity*, was published in 1991 by AM Press on the occasion of his 75th birthday. He delivered invited lectures throughout the world; he was a Guggenheim Fellow in 1975 and an Alexander von Humboldt Fellow in 1986.

Ras Lee is survived by his four children and four grandchildren. He was predeceased by his wife, Shirley. Ras had a delightful personality and was well liked and admired by his many colleagues. He also inspired admiration and gratitude among his many post-doctoral and graduate students.

Ras Lee will be sorely missed, but his mechanics legacy will live on.

Vlado Lubarda