McCormick

Northwestern Engineering

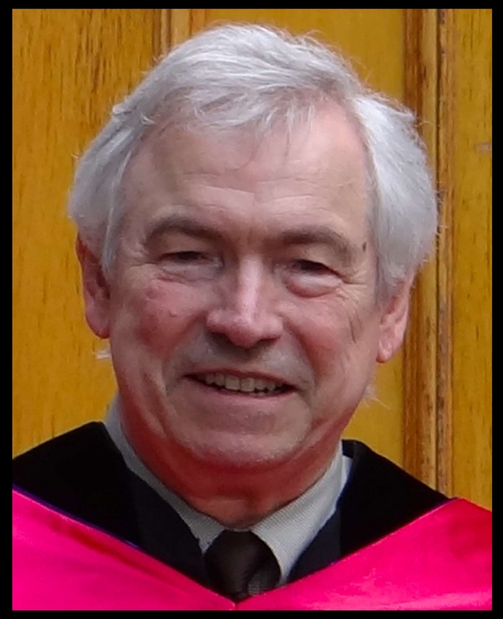
The Civil and Environmental Engineering and Mechanical Engineering Departments

The Jan D. Achenbach Lecture

Mechanics on the Great Ice Sheets

James R. Rice

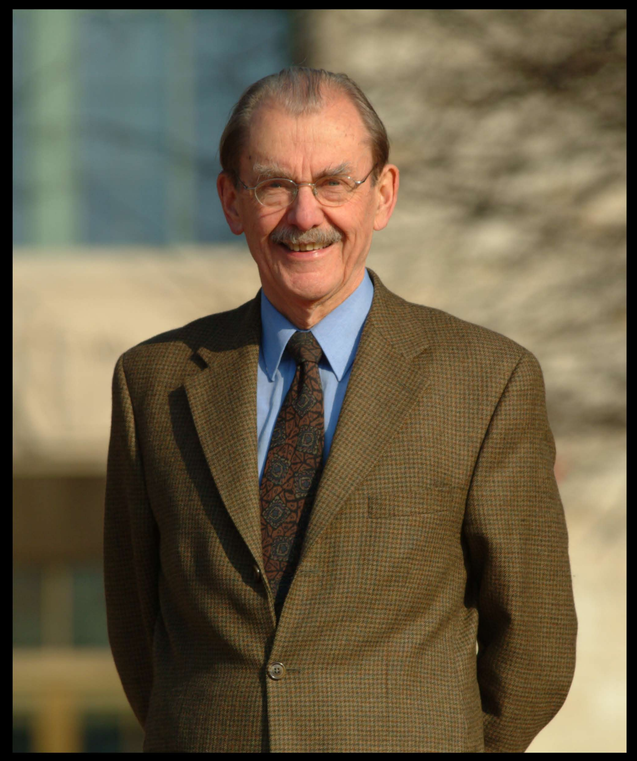
Harvard University



May 16, 2014
3:00 p.m.
Ford ITW

Concepts of solid and fluid mechanics, integrated with materials and thermal sciences, provide a valuable framework for addressing large-scale phenomena of flow, fracture, and hydrology on our planet's major ice sheets. This presentation surveys their application to the following: (a) Large iceberg calving as the enigmatic source of the long-period glacial earthquakes identified along the margins of the Greenland Ice Sheet, (b) Rapid glacial underflooding events as natural hydraulic fractures, like in a well-characterized spontaneous supra-glacial lake drainage on Greenland, and (c) Partial internal melting from shear heating as a control on flow resistance at the margins of the rapidly flowing (> 100 m/yr) ice streams on the Western Antarctic Ice Sheet, and perhaps as a process selecting their marginal locations. The studies have been done at Harvard in collaboration with Victor C. Tsai (now at Caltech), Thibaut Perol, John D. Platt, Jenny Suckale (now at Stanford), Colin R. Meyer, and Matheus Fernandes. They are pursued as part of a global effort to better quantify expected ice mass loss rates, related sea-level rise, and ice-sheet effects from, and on, changes in the climate system.

James R. Rice is the Mallinckrodt Professor of Engineering Sciences and Geophysics at Harvard, where he has been since 1981. From 1965 to 1981 he was an engineering faculty member at Brown, and his prior education was in mechanics at Lehigh. Rice's focus in recent years is on mechanics directed to earth and environmental problems, including fault zone processes, earthquake nucleation, dynamic rupture propagation, meltwater interactions with glacier dynamics, landslide processes, and general hydrologic phenomena involving fluid interactions in deformation, flow and failure of earth materials. Earlier, his work focused on plastic deformation and cracking processes, principally in metals, as they arise in mechanical and materials engineering and on related computational and analytical methodology.



Jan D. Achenbach

Born in the Netherlands, Achenbach became a member of Northwestern's faculty in 1963. Since then, he has become highly respected for his work in the areas of wave propagation in solids and for pioneering the field of quantitative non-destructive evaluation.

The Jan D. Achenbach Lecture recognizes Achenbach for his extraordinary contributions to the field of mechanics, as well as his profound impact on McCormick's departments of Mechanical Engineering, Civil and Environmental Engineering, and Engineering Sciences and Applied Mathematics.

Achenbach received a National Medal of Technology in 2003 for his contributions to engineering research and education and for pioneering methods for detecting dangerous cracks and corrosion in aircraft, advances that have led to improved air safety. He was also awarded a 2005 National Medal of Science, the nation's highest honor for innovation in technology and science.

He was elected a member of the National Academy of Engineering in 1982, a member of the National Academy of Sciences in 1992, and a fellow of the American Academy of Arts and Sciences in 1994. In 1999, he was elected a corresponding member of the Royal Dutch Academy of Sciences, and in 2009, he was elected a fellow of the World Class Universities Program of the National Research Foundation of Korea. He is also an honorary member of the American Society of Mechanical Engineers and a fellow of ASME, ASA, SES, AMA, and AAAS. His awards include the 2012 ASME Medal, the Timoshenko Medal, the William Prager Medal, and the Theodore von Karman Medal. In 2011, he was awarded a rare honorary doctorate degree from China's Zhejiang University.

Achenbach is founder of Northwestern's Center for Quality Engineering and Failure Prevention, a state-of-the-art laboratory for quality control in structural mechanics.

We would like to thank the generous donations that have made the establishment of the Jan D. Achenbach Lecture possible:

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