

# Kalman Receives National Medal of Science



**Rudolf Kalman receiving National Medal of Science from President Barack Obama.**

Rudolf Kalman has received the 2008 National Medal of Science, the highest honor the United States gives for scientific achievement. President Barack Obama honored Kalman and eight other medalists in an awards ceremony at the White House on October 7, 2009.

## **The Work of Rudolf Kalman**

The *Notices* asked Eduardo Sontag of Rutgers University, a Ph.D. student of Rudolf Kalman, to describe briefly Kalman's achievements. Sontag writes:

"Among Kalman's early work was the development of what is now called the Kalman filter for detection of signals in noise. This revolutionized the field of estimation, by providing a recursive approach to the filtering problem. Before the advent of the Kalman filter, most mathematical work was based on Norbert Wiener's ideas, but the 'Wiener filtering' had proved difficult to apply. Kalman's approach, based on the use of state space techniques and a recursive least-squares algorithm, opened up many new theoretical and practical

possibilities. The impact of Kalman filtering on all areas of applied mathematics, engineering, and sciences has been tremendous. It is impossible to even begin to enumerate its practical applications. Just as examples of their diversity, one may mention the guidance of the Apollo spacecraft and of commercial airplanes, uses in seismic data processing, nuclear power plant instrumentation, and demographic models, as well as applications in econometrics.

"During the 1960s, Kalman was the leader in the development of a rigorous theory of control systems. He formulated and clarified a number of fundamental notions, such as controllability, observability, and minimality, that are nowadays central to the theory. During the 1970s, he played a major role in the introduction of sophisticated mathematical techniques in the study of linear as well as nonlinear systems, in the former area pioneering the study of moduli spaces of linear systems and in the latter introducing the view of internal states as spectra of observation algebras. His recent work has concentrated on a system-theoretic approach to the foundations of statistics and identification, as well as on classical problems of passive network synthesis."

## **Biographical Sketch**

Rudolf Kalman was born on May 19, 1930, in Budapest. He obtained a bachelor's degree (1953) and a master's degree (1954) from the Massachusetts Institute of Technology, and a D. Sci. degree (1957) from Columbia University, all in electrical engineering.

Kalman worked as a research mathematician at RIAS (the Research Institute for Advanced Study, in Baltimore) from 1958 until 1964. He subsequently became a professor at Stanford University (1964-1971) and later a graduate research professor jointly in the departments of mathematics,

electrical engineering, and industrial and systems engineering at the University of Florida, where he also established the Center for Mathematical System Theory, directing it until his retirement in 1992. In 1973, he was elected to an *ad personam* chair in mathematical system theory at the Eidgenössisches Technische Hochschule in Zürich, a position he held until compulsory retirement in 1997.

Kalman is a member of the U.S. National Academy of Sciences, the U.S. National Academy of Engineering, and the American Academy of Arts and Sciences. He is also a foreign member of the Hungarian, French, and Russian Academies of Science and is the holder of many honorary doctorates. He was awarded the IEEE Medal of Honor in 1974, the IEEE Centennial Medal in 1984, the Inamori Foundation's Kyoto Prize in High Technology in 1985, the AMS Steele Prize in 1987, the Richard E. Bellman Control Heritage Award in 1997, and the NAE Charles Stark Draper Prize in 2008.

#### About the National Medal of Science

Awarded annually and administered for the White House by the National Science Foundation, the National Medal of Science celebrated its fiftieth anniversary since being created by statute in 1959. The Medal recognizes individuals who have made outstanding contributions to science and engineering, based on their advanced knowledge in, and contributions to, the biological, behavioral/social and physical sciences, as well as chemistry, engineering, computing and mathematics.

—Allyn Jackson

#### About the Cover

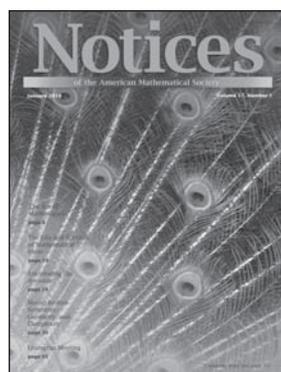
##### Creativity issue

This issue is dedicated to mathematics and its interaction with art. The peacock's tail is intended to represent this symbiosis.

The cover photo was taken by mathematician-photographer Geir Arne Hjelle at De Apenheul zoo just outside Apeldoorn, Netherlands.

The cover image was composed using GIMP (GNU Image Manipulation Program) freeware. See <http://www.gimp.org/>. The cover concept and design are by Geir Arne Hjelle and Marie Taxis.

—Steven G. Krantz



 The advertisement is set against a dark grey background. At the top right, the 'Powell's TECHNICAL BOOKS' logo is displayed, featuring a stylized molecular structure with three spheres and connecting lines. In the center, a large, light grey silhouette of a cat's head is visible, with its ears pointed. Below the cat silhouette, the text 'SELL US YOUR BOOKS' is written in a large, white, serif font. Underneath this, in a smaller white font, is the text: 'Powell's Technical Books is always seeking university- and research-level mathematics titles. To inquire about selling single volumes or an entire library, email [uba@technical.powells.com](mailto:uba@technical.powells.com) or call 800-878-7323 ext. 4000.' At the bottom, another line of white text reads: 'To shop our current inventory of used and new volumes, please visit us at [Powells.com](http://Powells.com).'