



Bruce C. Bolt

BRUCE ALAN BOLT

1930–2005

Elected in 1978

“For application of the principles of seismology and applied mathematics to engineering decisions and public policy.”

BY DAVID BRILLINGER, JOSEPH PENZIEN,
AND BARBARA ROMANOWICZ

BRUCE ALAN BOLT, Professor Emeritus of Seismology at the University of California, Berkeley, died suddenly of pancreatic cancer at Kaiser Permanente Medical Center in Oakland, California, on July 21, 2005.

Professor Bolt was born on February 15, 1930, in the small town of Largs, New South Wales, Australia. He attended East Maitland Public School, Maitland Boys’ High School, Newcastle Technical College, and the University of Sydney (at Armidale) where he majored in mathematics and physics and received a B.Sc. with honors in applied mathematics in 1952. After a year at Sydney Teachers’ College (Diploma of Education) he taught mathematics and physics at Sydney Boys’ High School. He was then appointed to the faculty in the Mathematics Department at the University of Sydney, where he received an M.Sc. and Ph.D. in 1955 and 1959, respectively. In 1972, he was awarded a D.Sc. by the University of Sydney.

After completion of his Ph.D. in elastic wave theory, he won a Fulbright scholarship to Lamont Geological Observatory at Columbia University in 1960 and to Cambridge University (U.K.) in 1961. There he met the late Perry Byerly, Professor of Seismology at University of California, Berkeley (UCB), which led to an invitation to a chair in seismology at UCB in 1963.

From 1963 to 1993, he was professor of seismology in the Department of Geology and Geophysics at UCB and director of the UCB seismographic stations from 1963 to 1989. In his early years at UCB, while pursuing his interests in the study of earthquakes and the earth's deep structure, Professor Bolt also developed strong research interests with other faculty members in structural and geotechnical engineering, and from 1983 to 1993, he was professor of civil and environmental engineering. Upon retiring from UCB in 1993, he received the university's highest honor, the Berkeley Citation. He then became Professor Emeritus of Seismology and professor in the graduate school. He continued to engage in academic activities until his death on July 21, 2005.

As a lecturer and senior lecturer at the University of Sydney, Professor Bolt developed expertise in applied mathematics, statistics, and geophysics, and he continued to make valuable contributions in these areas throughout his career. His strongest desire was to understand natural phenomena and to describe them mathematically and statistically. He wrote numerous innovative papers pertaining to the deep earth, dispersion, free oscillations, seismology, and statistics. His first published paper, in 1957, was a note in *Nature*, followed by a note in *Geophysical Journal of the Royal Astronomical Society*, on seismic observations of the 1956 atomic explosions in Australia. In 1960, he published a paper with John Butcher on the dispersion of seismic waves. This paper signaled the beginning of his involvement with large data sets and digital computing.

His creative use of statistical methodologies, influenced by Harold Jeffreys, led to the estimation technique of revising earthquake epicenters that is still in use today. He developed the method of robust regression some 10 years before others in the field. His many contributions to seismology, including the development of earth models, involved finite-element methods, elastic wave-propagation theory, broadband and digital recording, strong-motion array development, data collection and interpretation, attenuation relations, and earthquake statistics.

Professor Bolt published almost 200 research papers and wrote six and edited eight textbooks on earthquakes, geology, and com-

puters, among other topics. His numerous publications include four very popular books: *Earthquakes: A Primer* (1978); *Inside the Earth: Evidence from Earthquakes* (1982); *Earthquakes and Geological Discovery* (1993); and *Earthquakes* (5th ed., 2003).

In recognition of Professor Bolt's contributions to seismology, he was elected a fellow of the American Geophysical Union and the Geological Society of America, Associate of the Royal Astronomical Society, London, in 1987, and Overseas Fellow of Churchill College, Cambridge University, in 1980. He was president of the Seismological Society of America in 1974 and editor of its *Bulletin* from 1965 to 1972, president of the International Association of Seismology and Physics of the Earth's Interior from 1980 to 1983, president of the Consortium of Organizations for Strong-Motion Observation Systems (COSMOS), and president of the California Academy of Sciences (its medallist in 1989).

In addition to his many contributions to seismology, Professor Bolt made invaluable contributions to the field of earthquake engineering through his teaching of basic seismology to graduate students in structural and geotechnical engineering, his research characterizing strong ground motions for engineering design purposes, his consulting role on important engineering projects, and his participation on numerous panels, boards, and commissions. He was also an active participant in the UCB Earthquake Engineering Research Center.

Professor Bolt's consulting work was focused primarily on setting seismic criteria for new and retrofitted designs of critical structures, such as dams, nuclear power plants, large bridges, underground structures, and pipelines. These structures included the Aswan Dam, Diablo Canyon Nuclear Power Plant, Golden Gate Bridge, Bay Area Rapid Transit (BART) underground stations, BART transbay tube, and the Alaska Pipeline. His consulting work in 2005 included characterizing the controlling seismic sources and assessing tsunami risk for the design of a suspension bridge crossing the Messina Strait between Italy and Sicily. The main span of this bridge will be 3,300 meters long, more than twice the length of the main span (1,280 meters) of the Golden Gate Bridge.

Setting seismic design criteria for critical structures involves

identifying seismic-source zones, conducting seismic hazard analyses, generating site-specific response spectra and corresponding free-field ground motions, characterizing the spatial variations of ground motions, and predicting future fault offsets. In addition, he participated in the evaluation of the seismic performance of structures. With his strong background in applied mathematics and mechanics, he was able to communicate effectively with structural and geotechnical engineers on seismic-design and damage assessments.

The numerous seismic-related panels, boards, and commissions on which Professor Bolt served include the California Department of Water Resources Consulting Board, California Department of Transportation Seismic Advisory Board, San Francisco Bay Conservation and Development Commission Engineering Criteria Review Board, Metropolitan Transportation Commission Engineering and Design Advisory Panel, Golden Gate Bridge Seismic Instrumentation Panel, and the California Seismic Safety Commission (CSSC). As a member and chair of CSSC, he participated in the sponsorship of numerous bills that eventually became law in California and have greatly improved seismic hazard mitigation throughout the state.

In recognition of Professor Bolt's many contributions to earthquake engineering, he received the Earthquake Engineering Research Institute 2000 George W. Housner Medal, the California Earthquake Safety Foundation 1995 Alfred E. Alquist Medal, and was elected to the National Academy of Engineering (NAE) in 1978. His NAE citation reads: "For the application of the principles of seismology and applied mathematics to engineering decisions and public policy."

Having served as chair of the UCB Academic Senate (1992–1993) and, for many years, as president of the Faculty Club, Professor Bolt seemed to know everyone on the Berkeley campus. In addition, he developed close relationships with a myriad of scientists and engineers worldwide. Whenever he met one of his many close friends, he extended a warm greeting with a big smile. His personal character was admired by everyone who had the pleasure of knowing him, and he will be greatly missed by his friends, colleagues, and students.

Professor Bolt is survived by his wife Beverley (nee Bentley) of Berkeley, California; three daughters, Gillian Bolt Kohli of Wellesley, Massachusetts, Helen Bolt Juarez of Fremont, California, and Margaret Bolt Barber of Orinda, California; a son, Robert Bolt of Hillsborough, California; a sister, Fay Bolt of Sydney, Australia; and 16 grandchildren.