

Hojjat Adeli

RICHARD G. WEINGARDT, P.E., DIST. M. ASCE

High among the world's elite engineering educators stands Hojjat Adeli, universally renowned for his many leading-edge and pioneering contributions to a multitude of different engineering and scientific disciplines. His abundant writings and trailblazing work in the application of new and emerging computing and information technologies in civil engineering have greatly impacted engineering education practice internationally.

With a lifelong goal to create the "engineering of the future," Adeli has been a role model, mentor, and/or inspiration to countless students, followers, and colleagues. About his engineering and research philosophy, he takes pride in saying, "I break the boundaries of disciplines." He defines research as "inventing the future" and says "instilling the joy of discovery and invention in young engineers" has been his goal. He has also been a visionary in the image enhancement of civil engineers through innovation and advancing high technology.

C. V. Ramamoorthy, at the University of California, Berkeley, likened Adeli to the eighteenth-century Swiss mathematician, engineer, and scientist Leonhard Euler, stating, "Hojjat Adeli is an extraordinary engineer, applied mathematician, and computer scientist all at the same time, in the tradition of the legendary Euler. He has made numerous seminal contributions in a wide range of areas within the broad field of computational science and engineering, including computational structural engineering, and has been a pioneering figure in the areas of computational intelligence and smart structures. He is one of the founders of the field of 'knowledge engineering.' His ingenious computational models have found applications in many diverse areas, from intelligent transportation

systems to biomedical engineering, neuroengineering, and computational neuroscience."

When Adeli was elevated to the level of Honorary (Distinguished) Member of ASCE in 2005, *ASCE News* reported, "Adeli's extraordinary leadership has earned him an international reputation as a renowned scholar and one of the most prolific and widely cited civil engineering educators in the world of computer-aided engineering. His contributions in the areas of computational intelligence, knowledge engineering, and high-performance computing systems have been highly influential and original. His innovative research includes the invention of a robust design optimization computational model and algorithm for the fully automated design of such large structures as high-rises (for which he holds a U.S. patent), the development of traffic incident detection techniques for intelligent transportation systems, and the creation of active and hybrid control systems and smart structure technology allowing sensors and actuators to work together to resist such dynamic forces as heavy truck loads on bridges and wind or earthquake forces on bridges and high-rises."

Hojjat was born June 3, 1950, in a small Iranian town on the southern shores of the Caspian Sea to a physician father, Jafar Adeli-Rankouhi, and a homemaker mother, Mokarrameh Sufi. He was the third of five children and with his siblings spent his youth in Lahijan, a lake town surrounded by bucolic tea farms. His father was the head of the city's health department and, at times, meaningfully involved in local politics. His mother was from a family of landowners with roots to the Safavid dynasty in the fifteenth century and founders of Sufism.

During much of Hojjat's childhood and adolescence, his mother was bedridden with various illnesses such as lupus, breast cancer, and a stroke. Hojjat coped with her suffering by burying himself in books. He was especially interested in history and the people behind notable scientific and engineering feats and discoveries. Among those he most admired were Marie and Pierre Curie, Albert Einstein, and Gustave Eiffel.

Historical rulers also captured his imagination. He said, "My first inspiration in my childhood was Cyrus the Great, who built the great Persian civilization, and Darius the Great, who built the Persepolis more than twenty-five centuries ago." Hojjat was additionally fascinated by great historical monuments such as the Pyramids of Giza, Persepolis, and the latter-day Eiffel Tower. According to Adeli, "In elementary school, I actually built a five-foot-tall wooden model of the Eiffel Tower."

Jafar's dream was for his son to follow in his footsteps and pursue medicine. Instead, Hojjat decided to study civil and structural engineering. He said, "As a child, I believed civil engineers built civilizations (and I still do). I wanted to have an impact on the modernization of Iran, as the country had fallen behind over the previous one and a half centuries due to political turmoil, intervention of foreign powers, and inept governments."

Math and science were Adeli's favorite subjects in elementary and high school. He was convinced they were the most important tools engineers used in performing their great works. By high school, he was an avid scholar of the ninth-century Persian mathematician and astronomer Al-Kharezmi. Said Adeli, "He introduced the concepts of algebra into European mathematics. A lot of my work in the past three decades

involves development of algorithms for solution of engineering problems.”

Once Hojjat decided against being a doctor and to go into engineering instead, his father became a reluctant supporter of his choice. Remembered Adeli, “I used to tell him I wanted to become an engineer because I liked math. He used to tell me, ‘You can be a great physician if you are a great mathematician.’ I did not believe him at the time. I thought he was saying that because he wanted me to be a physician. Now I realize he was right since, for technological advances in medicine, you need advanced math. I am now using my math knowledge to create technologies to help physicians diagnose complicated neurological disorders such as epilepsy, autism, and Alzheimer’s disease.”

Adeli received his B.S. and M.S. in civil engineering from the University of Tehran (UT), Iran’s most prestigious institution of higher learning. In 1973, he earned the highest rank among all graduates of the various departments of UT’s College of Engineering and was awarded the Medal of Education. It was placed on his lapel by no less than the Shah of Iran during a special graduation ceremony.

One day, during his last year at UT while working on his master’s degree, Hojjat was studying at the Main Library when he looked up and saw an attractive young lady with light green eyes staring and smiling at him. (They still tease today about who actually smiled first!) The young lady was Nahid Dadmehr, a first-year medical student at UT. They quickly became close friends and, later, much more.

In college, in addition to the Swiss-born Euler, another hero of Hojjat’s was the Ukrainian-born Stephen Timoshenko, universally regarded as the father of modern structural mechanics and a living legend at the time. Timoshenko was still active as a professor at Stanford University when Hojjat decided to pursue a doctoral degree in engineering, and that influenced him to enroll at Stan-

ford. However, by the time Adeli arrived on the Stanford campus in January 1974, the great Timoshenko had unfortunately passed away.

Shortly after his arrival at Stanford, Adeli was employed as a research assistant by William Weaver, another outstanding Stanford professor and scholar and the author of several books. Adeli earned his Ph.D. in civil engineering from Stanford in June 1976, at age 26, only 30 months after enrolling in the school’s doctorate program.

When Adeli entered Stanford, his full name was Hojjatollah Adeli-Rankouhi. Right after receiving his Ph.D., he abbreviated his name and officially became known as Hojjat Adeli.

In the latter half of 1976, Adeli signed up with George Herrmann, chairman of applied mechanics at Stanford, to work with him as a postdoctoral research associate in the area of fracture dynamics, a new discipline at the time, even though his main area of expertise had been in structures, not engineering mechanics.

After Stanford, Adeli moved to Northwestern University as a junior faculty member. He recalled, “During this time Iran was undergoing rapid development after the quadrupling of oil prices a few years earlier. After one year at Northwestern, I was young and idealistic, with a Peace Corps type of mentality, and I decided to go back to my motherland in order to serve the people there and help with the country’s development.” Adeli took a faculty position at UT in January of 1978.

He said, “In 1979, just as I was adapting to my new academic life back home, the Iranian Revolution came down like an avalanche. The first six months were actually a period of awakening, enlightenment, and true democracy. But then things changed fast. The universities were shut down, and the country went through a Cultural Revolution resulting in deterioration of the scientific and technical environments.”

A few months after the revolution began, Adeli and Nahid married. By then, she was a medical intern at UT’s College of Medicine. They lived in a townhouse in Tehran, a four-story, four-unit building owned by his parents, who also lived in one of the units. The families of an older sister and older brother lived in the other two units. According to Adeli, “This was the way many deep-rooted Persian families lived.”

Adding to the chaos of the postrevolution was the eruption of the Iran-Iraq war, during which the government closed the country’s borders completely. Adeli still has vivid memories of Saddam Hussein’s missiles hitting Tehran indiscriminately around midnight on a regular basis. In 1980, Adeli decided to get his family out of the country and began making plans. It would not be easy.

In 1981, the Adelis were blessed with twins, Amir and Anahita. Shortly after, Adeli was given permission to leave the country briefly to attend an earthquake engineering conference in Greece—without his wife and infant children.

In June 1982, he was allowed to visit the United States on a two-month visitor’s visa—again, without his family—to present a paper at a conference in Seattle, Wash. Around the same time, he was invited to present a research seminar at the University of Utah, where he received an offer to teach conditional upon receiving a labor certificate and an H1 visa. The approvals came in time for the fall quarter, just a few days before classes started. But his wife and two children were still in Iran, Nahid in her third-year residency in ophthalmology.

A short time later, according to Adeli, “Finally, fortunately and with some draw of luck, I managed to bring my wife and family to America.” They would all become U.S. citizens five years later.



Figure 1. Hojjat Adeli (center) with Gordon Gee, President of Ohio State University, and Fulbright Scholar Kwoting Fang (Photo courtesy of Hojjat Adeli)

In June 1983, Adeli joined Ohio State University (OSU) as an associate professor of engineering. Five years later, Adeli became a full professor and chairman of OSU's structures faculty. He is currently professor of civil and environmental engineering and geodetic science and the holder of the Abba G. Lichtenstein Professorship. In addition, he is a professor in the departments of aerospace engineering, biomedical engineering, biomedical informatics, electrical and computer engineering, neurological surgery, and neuroscience (Fig. 1). His involvement in these areas has allowed him to delve into the human brain and create technologies that help patients with neurological disorders. With his Ph.D. students and research associates, he has invented technologies for automated seizure detection and diagnosis of epilepsy and attention deficit hyperactivity disorder (Fig. 2). This technology is being extended for early onset diagnosis of Alzheimer's disease.

In his OSU bridge engineering classes, with a special affinity for design and concern with "things beautiful," Adeli highlights the design parameters of some of the most unique and beautiful bridges in the world. Similarly, his

advanced structural design classes are sprinkled with design of some of the most unusual high-rise buildings in the world.

In its June 1987 issue, *Civil Engineering* ran a feature story on Adeli's innova-

tive synergistic man-machine approach to the interactive microcomputer-aided design of structures and cited his meaningful use of information technology in design as a major improvement in the quality of undergraduate education. In 1998, he and one of his former Ph.D. students, H. S. Park, designed an unusual 144-story high-rise building structure—taller than any high-rise building structure ever designed at the time—using their unique patented neural dynamics model.

Adeli is the author of more than 450 research publications, including 240 journal articles and more than a dozen books. His pioneering and wide-ranging research has been published in 74 different computer science, engineering, medical, and applied mathematics journals. In addition to these writings, he is (or has been) an editor, associate editor, or editorial board member of 110 journals. He is, for example, the editor-in-chief of *Computer-Aided Civil and Infrastructure Engineering*, which he founded in 1986, *Integrated Computer-*



Figure 2. Adeli (third from left, front row) with his graduate students and research associates at Ohio State University in 2002 (Photo courtesy of Hojjat Adeli)



Figure 3. Adeli explaining the behavior of irregular tall buildings during his Keynote Lecture at the Malta International Conference in 2007 (Photo courtesy of Hojjat Adeli)

Aided Engineering, which he founded in 1993, and the *International Journal of Neural Systems*.

Adeli has also been the chair, cochair, or honorary chair of 19 international computing conferences and a member of the organizing or scientific committees of more than 300 conferences held in 60 different countries. At 74 of them, he presented the keynote lecture (Fig. 3). Since 1989, he has presented papers at 157 conferences on six continents. He has written major books in three main areas of civil engineering and is the author or coauthor of 14 seminal engineering and scientific books:

1. *Interactive Microcomputer-Aided Structural Steel Design*
2. *Expert Systems for Structural Design: A New Generation*
3. *Parallel Processing in Structural Engineering*
4. *Machine Learning: Neural Networks, Genetic Algorithms, and Fuzzy Systems*
5. *Neurocomputing for Design Automation*
6. *Distributed Computer-Aided Engineering for Analysis, Design, and Visualization*
7. *High-Performance Computing in Structural Engineering*
8. *Control, Optimization, and Smart Structures: High-Performance Bridges and Buildings of the Future*

9. *Construction Scheduling, Cost Optimization, and Management: A New Model Based on Neurocomputing and Object Technologies*
10. *Wavelets in Intelligent Transportation Systems*
11. *Cost Optimization of Structures: Fuzzy Logic, Genetic Algorithms, and Parallel Computing*
12. *Intelligent Infrastructure: Neural Networks, Wavelets, and Chaos Theory for Intelligent Transportation Systems and Smart Structures*
13. *Wavelet-Based Vibration Control of Smart Buildings and Bridges*
14. *Automated EEG-Based Diagnosis of Neurological Disorders*

About his book *Control, Optimization, and Smart Structures*, the *ASCE Journal of Structural Engineering* wrote in 2000, “Hojjat Adeli is renowned for creating new fields and writing pioneering, highly innovative, and trend-setting computing and high-technology books. He has done it again by writing another truly groundbreaking book. In this cutting-edge cross-disciplinary book, computational models and algorithms are presented for active control of a new generation of large adaptive structures subjected to such varied types of dynamic loading as impact, wind, earthquake, and blast loading. This is achieved through ingenious integration of five different disciplines/technologies: control, optimization, sensor/actuator technology, structural engineering and high-performance computing.”

In addition to writing 14 state-of-the-art engineering books, Adeli has edited 13 others, including *Expert Systems in Construction and Structural Engineering*, *Advances in Design Optimization*, and *Historic Bridges: Evaluation, Preservation, and Management* (Figs. 4–9).

Included among Adeli’s numerous honors and awards are the following:

- Lumley Research Award, OSU College of Engineering, 1990, 1994, 1998, and 2002
- Outstanding Ohioan, Senate of the

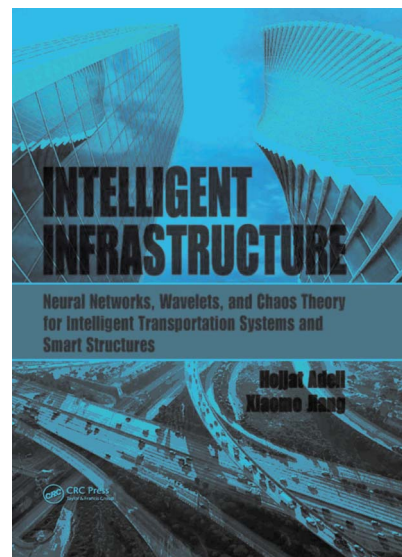


Figure 4. Cover of the book *Intelligent Infrastructure* (Photo courtesy of Hojjat Adeli)

122nd General Assembly of State of Ohio, 1998

- Distinguished Scholar Award, OSU, 1998
- Construction Management Award, ASCE, 2006

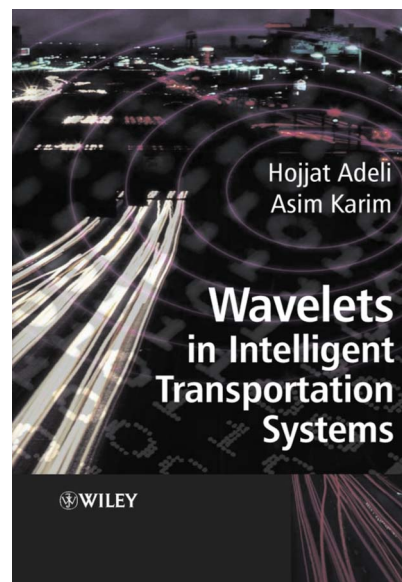


Figure 5. Cover of the book *Wavelets in Intelligent Transportation Systems* (Photo courtesy of Hojjat Adeli)

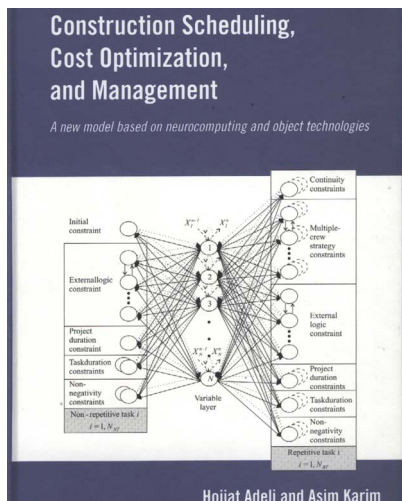


Figure 6. Cover of the book *Construction Scheduling, Cost Optimization, and Management* (Photo courtesy of Hojjat Adeli)

- Peter and Clara Scott Award, OSU College of Engineering, 2007
- Charles E. MacQuigg Award, OSU College of Engineering, 2007

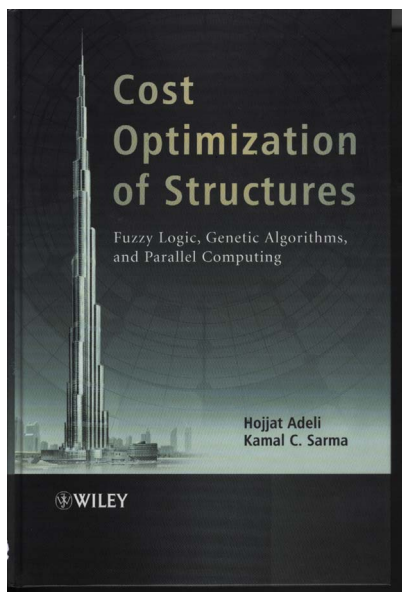


Figure 7. Cover of the book *Cost Optimization of Structures: Fuzzy Logic, Genetic Algorithms, and Parallel Computing* (Photo courtesy of Hojjat Adeli)

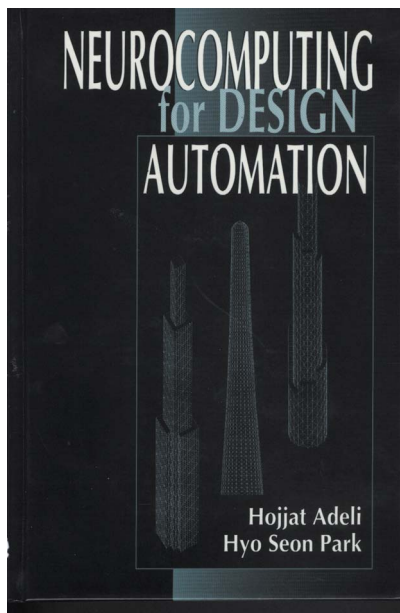


Figure 8. Cover of the book *Neurocomputing for Design Automation* (Photo courtesy of Hojjat Adeli)

- Outstanding Civil Engineer, ASCE Central Ohio Section, 2009

When he was elected fellow of the American Association for the Advance-

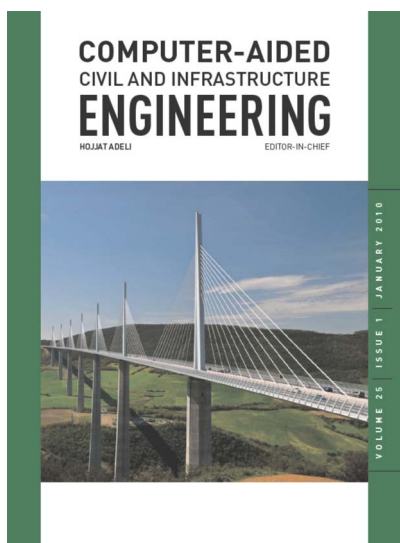


Figure 9. Cover of the *Journal of Computer-Aided Civil and Infrastructure Engineering* (Photo courtesy of Hojjat Adeli)

ment of Science in 2008, Adeli's citation read, "For distinguished contributions to computational infrastructure engineering and for worldwide leadership in computational science and engineering."

Majid Manzari of George Washington University, a former student, encapsulated Adeli's impact on his students and the direction they take: "He has inspired countless students who are now leading scholars across the world." In 1998, OSU's *onCampus* reported, "Whether Adeli is designing earthquake-resistant bridges and buildings or finding better ways to track traffic incidents on highways, he does not follow established paths in engineering, but rather makes his own. Many doctoral students have chosen to pursue their degrees at OSU specifically because of Adeli's international reputation as an innovator and researcher, who is ahead of the time for his building bridges between new computer science tools and the many disciplines of engineering."

Pete Loucks, Cornell University, said, "What a man. What a scholar. And what a record of accomplishments, not just in one or two disciplines, but in over a dozen. I have absolutely no idea how anyone can possibly have written as many high-quality papers and books and served on as many professional committees and boards."

Stated Enders Robinson of Columbia University, "Adeli helped define and shape the field of computational intelligence beginning in early 1990s. His books and articles are visionary and groundbreaking. Many of them have become classics. The breadth and depth of his contributions from engineering to medicine are breathtaking."

Amir Mirmiran, a former student and now Dean of Engineering at Florida International University, said, "I was inspired by him to pursue graduate studies and get a Ph.D. He had this kind of profound impact on the lives of many of his students. We looked up to him as a

role model. His contributions to the advancement of computing and information technologies in civil engineering in the past three decades has been nothing short of phenomenal. I cannot think of anyone else who has impacted and moved the frontiers of the three fields of construction engineering, structural engineering, and transportation engineering simultaneously, with seminal and groundbreaking books in all three areas. His widespread international influence in engineering is breathtaking.”

Asad Esmaily, at Kansas State University, said, “The inspiration by Dr. Adeli during my very first years of higher education had a significant impact on my educational path and selection of my field of study. I remember my close relatives wanted me to become a medical doctor, and I was ready to make that transition. However, attending a couple of Professor Adeli’s classes developed my ‘engineering taste’

and profoundly changed my decision. He not only teaches the technical material effectively, but also inspires students in a way that changes their lives. I have learned from Dr. Adeli life lessons that cannot be found in books. His work is truly about creating the engineering of tomorrow.”

On a personal level, Adeli’s overall sense of aesthetics can be seen in the way he lives and even the way he dresses—shirts and ties the same color (mostly blue), often with bold patterns on one or the other, or both. When his current house was built nearly two decades ago, he had major input in its planning and eclectic design. Its exterior has stone on three sides and brick on the fourth, and a 39-foot-tall turret is on the front side, which gives the house the appearance of a modern castle. Beautiful Persian rugs grace every room. Because it is one of the unique houses in Powell, Ohio, a north-west suburb of Columbus, drivers-by

frequently stop their cars to take view and pictures of the house.

The Adelis’ twins are both physicians. Their third child, Mona, born in 1991, is also pursuing medicine. Their youngest child, Cyrus, born in 1993, is showing a strong interest in following the path of his father to become an engineer.

When not creating new knowledge and technologies or doing scholarly work, Adeli enjoys listening to classical music, taking strolls in the woods, and playing tennis, table tennis, or backgammon.

Richard G. Weingardt is the chairman of the board of Richard Weingardt Consultants, Inc., Denver, Colorado. His latest book, published by ASCE Press, is *Circles in the Sky: The Life and Times of George Ferris*. He can be reached by e-mail at rweingardt@aol.com.