Prof. Leon O. Chua, ***University of California, Berkeley, USA***

Leon O. Chua received the MSEE from Massachusetts Institute of Technology in 1961, and the Ph.D. from University of Illinois, Urban-Champaign in 1964. After that he was Assistant and Associate Professor at Purdue University until 1970. He became a Professor of Electrical Engineering and Computer Sciences at University of California at Berkeley since 1971.

Dr. Chua is known internationally as a pioneer in 3 major research areas, namely, neural networks, chaos and nonlinear circuits. His word in these areas has been recognized internationally through numerous major awards, including 11 honorary doctorates from major universities in Europe and Japan, and 7 USA patents. He was elected Fellow of IEEE in 1974, a foreign member of the European Academy of Sciences (Academia Europea) in 1997, and a foreign member of the Hungarian Academy of Sciences in 2007. He was honored with many major IEEE prizes, including the IEEE Browder J. Thompson Memorial Prize Award in 1972, the IEEE W. R. G. Baker Prize Award in 1978, the Frederick Emmons Award in 1974, twice winner of the IEEE M.E. Van Valkenburg Award (1995 and 1998). He is also a Recipient of the top 15 most cited authors Award in 2002 from all fields of engineering published during the 10-year period from the Current Contents (ISI) database, the IEEE Neural Networks Pioneer Award in 2000, the IEEE Gustav Kirchhoff Award in 2005, and the IEEE Vitold Belevitch Award in 2007. Throughout his career, Dr. Chua has authored around 500 papers and 8 books. He is widely recognized as the father of nonlinear circuit theory and cellular neural networks (CNN). Dr. Chua also invented a five-element electronic circuit for generating chaotic signals. Known internationally as the Chua Circuit, it is used by many researchers to design secure communication systems based on chaos and has become a standard paradigm for teaching chaos in textbooks on nonlinear dynamics.

Keynote: A nonlinear dynamics perspective of Wolfram's new kind of science

Wolfram's monumental best seller entitled "A new kind of science" was based almost entirely on brute-force computer simulations. In sharp contrast, this 2-hour lecture presents a rigorous *analytical* theory based on *attractors* from a nonlinear dynamics perspective.

New results and concepts to be presented include the partitioning (via Felix Klein's Vierergruppe) of all 256 local Boolean rules studied empirically by Wolfram into 88 global equivalence classes, one of which contains 4 topologically-conjugate rules capable of universal computation, and endowed with a 1/f spectrum. Another major result is the rigorous characterization of the time-asymptotic dynamics (attractors) of 112 local rules via an explicit generalized *Bernoulli shift formula.*

Even more surprising, we have discovered the attractors of 170 local rules are blessed with the remarkable property of *time-reversality*. For such rules, the *past* evolution in time can be recovered from the *future* evolutions of a corresponding "twin" rule. Only 86 local rules exhibit an "arrow of time".

One of our most fascinating discoveries is a new phenomenon, dubbed an *"isle of Eden,"* having no counter part in hyperbolic differential equations, which has neither a past, nor a future!

In addition to providing a mathematical foundation for brainlike dynamics, the discoveries cited above provide a simple dynamical mechanism for mimicking many exotic phenomena from brain science, relativity, quantum physics, cosmology, etc.