Honorary Professor Talk Mini Symposium 2025

Feedback Control in Biological Systems

Péter Érdi

1: Center for Complex Systems Studies, Kalamazoo College;

2: HUN-REN Wigner Res. Centre for Physics

Peter.Erdi@kzoo.edu

Abstract:

Feedback control is a fundamental tool at every level of the biological hierarchy, from cellular to socio-ecological systems. It ensures homeostasis by adopting a general mechanism for restoring certain states after a small perturbation. Dynamical diseases occur due to the impairment of control systems. The theory of nonlinear dynamics offers a mathematical framework to analyze pathological temporal patterns. It aims to find control strategies to shift the physiological parameters back into normal ranges.

1 Cybernetics and Feedback Control
2 Homeostasis: A General Concept
(Prehistory, physiological homeostasis, the Gaia hypothesis
3 Applications: From Cellular Biology to Socio-ecological Systems
(Bistability, biological clocks, fight-or-fight response, emotional control.)
4 Dynamical Diseases
5 Cortical Networks
6 Ecological Systems
7 Lessons Learned: Cybernetics is With Us

Short CV:

Péter Érdi is the Head of the Department of Biophysics of the KFKI Research Institute for Particle and Nuclear Physics, Hungarian Academy of Sciences, Budapest, Hungary, and Henry R. Luce Professor at the Center for Complex Sytems Studies, Kalamazoo College, Kalamazoo, MI. His main scientific interest is computational modeling of the functional organization of the nervous system and other complex systems.

Affiliation

- Kalamazoo College, Center for Complex System Studies, Kalamazoo, MI
- Hungarian Academy of Sciences, Wigner Research Centre for Physics, Budapest, Hungary

Péter Érdi (born December 12, 1946) is a Hungarian-born computational neuroscientist who now lives in Michigan, United States where he is a Henry R. Luce Professor at Kalamazoo College. In his career he wrote several books and published (co-published) many scholarly articles in the fields of chemical kinetics, computational neuroscience and complex systems.

He was born in 1946 in Budapest, Hungary. He was the only son of Pál Érdi, a chief engineer at the tannery factory and Magdolna Friedmann, an office manager at the journal Nagyvilág. He has two children and two grandchildren. His mentors were Pál Benedek and János Szentágothai

After graduating in 1965 at János Bolyai High School, Budapest, he went on to study Chemistry at Eötvös Loránd University and Chemical Cybernetics at Budapest University of Technology and Economics where he completed Master's degrees in both disciplines. Eventually, in 1991 he received Doctor of Science (DSc) for his paper on "Kinetics of Chemical and Biological Networks".

In 2002, he and his family moved to Michigan, USA where he holds the Henry R. Luce professorship at Kalamazoo College while he kept his position in his home institution in Budapest.

In 1992, he began working as a scientific advisor of the KFKI Research Institute for Particle and Nuclear Physics of the Hungarian Academy of Sciences. He filled the role of the leading scientist on the project Big Data. Érdi's team was working on a method of predicting future technologies by analysing historical data of (mainly) US held patents.

In 1995 he began to hold a position as a University Professor at University of Debrecen and later, also at Budapest University of Technology and Economics. In between 1999 and 2002, he served as Széchenyi Professor at the Department of History and Philosophy of Science, Eötvös Loránd University, Budapest. After leaving Hungary and moving to the United States in 2002, he began his career as the Henry R. Luce Professor of Complex Systems Studies at Kalamazoo College. He has been awarded by the 2018 Florence J. Lucasse Fellowship for Excellence in Scholarship.

He also prides himself as the co-founder and co-director of BSCS (Budapest Semester in Cognitive Sciences), which is a Hungarian study program for undergraduate students, mainly from USA, that are interested in Cognitive Science and its disciplines.

In 1990, he established with János Tóth the informal organization ELMOHA (Hungarian acronym of the three words: Theory, Model, Tradition) with the primary goal of the group to establish a proper discussion between humanities and natural sciences. A group of intellectuals from various fields of sciences and humanities met up regularly and discussed science and the interpretations of science.

Early members of the group were Péter Balassa, János László Farkas, Péter Hraskó, György Kampis, József Lázár, János Malina, László Ropolyi, Róbert Schiller, Péter Marton. Also psychologist and linguist Csaba Pléh and Gábor Hraskó who is the president of Hungarian Skeptics Society, have also attended on several ELMOHA meetings. These meetings are often the subject of newspaper articles, books and university courses.