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Helyszín: A Szegedi Akadémiai Bizottság székháza, Szeged, Somogyi u. 7.
110. terem

Prof. Istvan Z. Kiss

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"Who Talks to Whom? Network Inference in Chemical and Biological Systems"

című előadására

(Az előadás angol nyelvű összefoglalója, ill. az előadó rövid szakmai életrajza alább található)

Minden érdeklődőt szeretettel várunk!

ABSTRACT

‘Who Talks to Whom? Network Inference in Chemical and Biological Systems’

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Networks in chemically reacting systems govern functionality across a wide range of scales, from chemical species connected through reaction pathways, to interacting reaction units in biological cells, to distributed networks of chemical manufacturing processes. Identifying the topology and functional form of these interactions is a fundamental step in developing predictive models of reaction kinetics, with applications spanning chemistry, biochemistry, and systems biology. However, reconstructing reliable networks from experimental observations remains challenging. A central difficulty is separating intrinsic dynamics from the influence of directly and indirectly coupled units, particularly when observations are limited, noisy, or incomplete due to hidden species or unobserved system components.

In this presentation, network inference techniques are applied to two representative systems: electrochemical reactions coupled through migration currents and external control signals, and gene expression dynamics in circadian cells within slices of the suprachiasmatic nucleus. Three complementary classes of network inference approaches are examined: regression-based methods using phase models, statistical approaches based on mutual information, and perturbation-based techniques. We demonstrate how data sufficiency measures can be used to assess the reliability of inferred networks in data-limited settings, how curvature analysis of kinetic trajectories can guide the design of perturbations that reveal coupling strengths directly, and how combining mutual information with transfer entropy in a multivariate framework improves the identification of network connections and directional influences. These studies illustrate how network-based approaches can provide mechanistic insight into complex interacting systems and establish practical strategies for reliable inference from incomplete observations.

Curriculum Vitae

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Istvan Z. Kiss earned his MS and PhD degrees in Chemistry from the University of Debrecen, Hungary. He worked as a Research Scientist at the University of Virginia's Department of Chemical Engineering before joining Saint Louis University's Chemistry Department, where he serves now as Eugene Kranz Professor of Chemistry. Dr. Kiss is recognized as an expert in the study of chemical reaction networks and nonlinear dynamics in far-from-equilibrium systems. Dr. Kiss has authored over 150 peer-reviewed publications in leading journals, including Science, Nature, PNAS, Angewandte Chemie, and Physical Review Letters. His accolades include a Cottrell College Science Award (2008), an NSF CAREER Award (2010), American Chemical Society St Louis Award, and leadership of the 2018 Gordon Research Conference on Oscillations. Dr. Kiss has received multiple awards from Saint Louis University, including a Research Institute Fellowship in 2022.