

Communicating Nonlinear Dynamics Across Boundaries via Interactive Simulations

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This talk will be a mix of "communicating" and "doing" science in different ways, aided by modern conceptual and computational tools. I will demonstrate the value of communication across disciplinary boundaries using real-time interactive simulations through VisualPDE.com. I will describe how past and ongoing work with developmental biologists, geographers, ecologists, and microbiologists can be enriched with these tools, and in particular how deep insights can be rapidly communicated without the need for vast disciplinary expertise. Among other examples, I will discuss stochasticity in 2D Rayleigh-Bénard convection, as well as the role of subcritical diffusion-driven instabilities in oncological, ecological, and embryological settings, demonstrating the ease with which nuanced and technical theoretical ideas can be illustrated and explored in real-time. I will end by discussing fundamental limitations of phenomenological dynamical systems modelling in general, giving rise to the need for better frameworks to do science.