

Pattern Formation via Blackboards and Web Browsers

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1. Abstract

Motivated by a range of problems in embryology and ecology, I will present recent extensions to Turing's classical reaction-diffusion paradigm for pattern formation. This will start by reviewing reaction-diffusion systems and their analysis via classical linear instability theory, followed by a range of generalizations to more realistic scenarios of reaction-transport models in complex domains. Such extensions are motivated by the evolving and heterogeneous landscapes of pattern formation in nature. Throughout this discussion, numerical simulations will play key roles in validating and extending the near-equilibrium theory. To drive home this last point, I will present VisualPDE, a new web-based simulator for lightning-fast interactive explorations of these systems. Such accessible numerical tools are invaluable for rapidly prototyping models of complex biological phenomena. Importantly, accessible simulations underscore the need for sound theory which goes beyond phenomenological modelling in biology.