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Poster *Abstract Submission Form*

PI(s) Grant: Krishna Garikipati
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Abstract Text

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Variational system identification of the partial differential equations governing the physics of pattern-formation in developmental biology

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We present a contribution to the field of system identification of partial differential equations (PDEs), with emphasis on discerning between competing mathematical models of pattern forming physics. The motivation comes from developmental biology, where pattern formation is central to the development of any multicellular organism. Direct applications exist to the development of the embryo across many classes of the animal kingdom, several organ systems in C elegans and D melanogaster, and cell segregation in many tissues. For each case, there is a collection of nonlinear, parabolic PDEs that, over suitable parameter intervals and regimes of physics, can resolve the evolving patterns with comparable fidelity. This observation frames the question of which PDE best describes the data at hand. This question is particularly compelling because identification of the closest representation to the true PDE, while constrained by the functional spaces considered relative to the data at hand, immediately delivers insights to the physics underlying pattern formation, and therefore to the molecular and cellular mechanisms of development. While building on recent work that uses stepwise regression, we present advances that leverage the variational framework and statistical tests. We also address the influences of variable fidelity and noise in the data.