Spatiotemporal System Reconstruction With Spectral Methods

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A reconstruction technique based on spectral methods is presented for spatiotemporal systems which are modeled by nonlinear partial differential equations of polynomial type up to arbitrary order and nonlinearity degree. Spectral differentiation operators are derived for spatial differentiation on periodic domains. It is demonstrated that, compared with finite differences, spectral reconstruction offers superior accuracy and works robustly with smaller set of sampling data. Implementation of the spectral reconstruction via FFT, together with an orthogonal decomposition and structure selection, is exemplified for a highly stiff reaction-diffusion system governed by the Kuramoto-Sivashinsky equation.

This is a joint work with Daolin Xu.