

No equations, no variables: data, and the computational modeling of complex systems.

Yannis G. Kevrekidis, CBE & PACM, Princeton University.

This Fall: Fischer Fellow, IAS-T. U. Muenchen

I will first briefly review how matrix-free, and, in particular, timestepper-based matrix-free methods, can functionally link fine-scale simulators with coarse-grained, systems-level numerical tasks (like coarse stability and bifurcation computations) for complex dynamical models.

I will then discuss what we are currently concerned about/working on in my group: the use of data-mining (the "variable-free" component) in the overall computational process. Processing the results of brief bursts of multiscale simulations with tools like Diffusion Maps can suggest good macro-scale observables (variables) in terms of which macroscopic equations can in principle be written/solved.

Performing scientific computation in terms of these "data-mining-based" variables poses a number of interesting problems that I will outline and discuss.