
Qiqi Wang
**Breaking causality: simulating chaotic dynamical systems
with Multigrid**

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We present a method of efficiently solving the "least squares problem" of time dependent differential equations with multigrid in time. We introduce the least squares problems and show its application to ergodic, chaotic dynamical systems. Unlike initial value problems, which are often hyperbolic or parabolic, we show that the least squares problem is an elliptic problem in time. The promises and challenges in using multigrid to efficiently solve this elliptic-in-time problem are discussed.