

CAAM 651 · TOPICS IN NUMERICAL LINEAR ALGEBRA

Numerical Methods for Dimension Reduction of Dynamical Systems

Spring 2009 · Rice University

This advanced course addresses the construction and analysis of reduced order models of large-scale dynamical systems. We shall first introduce basic concepts from systems theory, and then develop several state of the art numerical methods for reducing the dimension of large scale systems. Roughly three fourths of the course will be on linear dynamical systems and the remainder will introduce methods for nonlinear dynamical systems. The focus shall be on computational methods that have robust implementations and substantial theoretical underpinnings.

The class will be organized into five components: linear systems theory; dimension reduction by moment matching; dimension reduction by balanced truncation; the solution of Lyapunov equations; methods for reducing nonlinear systems. For each of these five areas we will propose a modest project that will typically involve applying concepts from the course to a physically-motivated dynamical system. Students may enroll for one to three credits; for each credit, each student is expected to complete one of the five projects.

The lectures should be accessible to all students with a good background in numerical linear algebra (e.g., CAAM 453).

Lectures: Tuesday 4-4:50 pm, Friday 3-3:50pm: Keck 107

Web Site: <http://www.caam.rice.edu/~caam651>

Instructors: Mark Embree (embree@rice.edu), Duncan Hall 3019, (713) 348-6160
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Prerequisites: Basic background in numerical linear algebra, on the level of CAAM 453

Credits: 1 credit per project, up to 3 credits
Students may choose from among the five projects to be proposed during the semester.

Grades: Students will be evaluated on their active participation in the course, their thorough completion of the assigned projects, and the literate presentation of the results of these investigations.

Any student with a disability requiring accommodation in this course is encouraged to contact to contact the instructors, and also to contact Disability Support Services in the Ley Student Center.