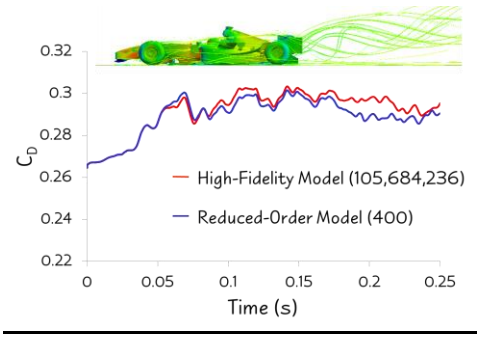
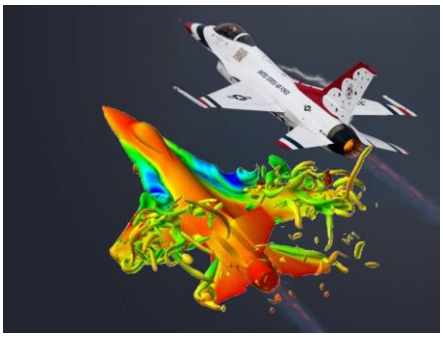
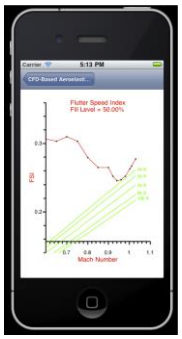
Stanford ENGINEERING
Aeronautics & Astronautics

AA216/CME345: Model Reduction

Schedule: Spring 21, T-Th 10:30 am – 11:50 am **Units :** 3
Venue : Remote – Synchronous







Course Description
Model reduction is an indispensable tool for computational-based design and optimization, statistical analysis, embedded computing, and real-time optimal control. It is also essential for scenarios where real-time simulation responses are desired. This course presents the basic mathematical theory for projection-based model order reduction. It is intended primarily for graduate students interested in computational sciences and engineering. The course material described below is complemented by a balanced set of theoretical, algorithmic, and MATLAB computer programming homework assignments.

Course Outline
Parametric modeling and simulation - Why model reduction? – Parameterized differential equations – Projection-based model order reduction – Error analysis – Proper Orthogonal Decomposition method – Linear dynamical systems – Balanced truncation methods – Moment matching methods based on Krylov subspaces – Local parametric approaches – Connections with Big Data – Nonlinear projection-based model order reduction.

Instructor
Charbel Farhat, Department of Aeronautics and Astronautics
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Office Hours: Tuesday, 4:00 pm – 5:30 pm; Thursday 4:00 pm – 5:30 pm – Remote

Teaching Assistant
Spencer Anderson, Department of Aeronautics and Astronautics
e-mail: aspenser@stanford.edu
Office Hours: Wednesday, 4:00 pm – 5:30 pm; Friday 12:30 pm – 2:00 pm – Remote

Prerequisites

- Solid foundations in numerical linear algebra (CME 200 or equivalent).
- Basic numerical methods for ODEs (CME 206 or equivalent).

Textbook

- Approximation of Large Scale Dynamical Systems, A.C. Antoulas, SIAM 2005.
- Lecture notes and reading materials provided by instructors.

Homeworks

- Assigned every two weeks.

Exam

- Assessment consistent with Stanford policy during COVID-19 pandemic.
- Subject to the Stanford Honor Code.

Course Grade

- Based 70% on the grades for the homework assignments.
- Based 30% on the grade for the Take Home Final Project.
- In fairness to all and in order to enable a timely posting of the solutions, homework assignments will be due on time or will not be graded.

Students with Documented Disabilities

Students who may need an academic accommodation based on the impact of a disability must initiate the request with the Student Disability Resource Center (SDRC) located within the Office of Accessible Education (OAE). SDRC staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an *Accommodation Letter* for faculty dated in the current quarter in which the request is being made. Students should contact the SDRC as soon as possible since timely notice is needed to coordinate accommodations. The OAE is located at 563 Salvatierra Walk (phone: 723-1066).