Numerical Methods for Partial Differential Equations (2.097J/6.339J/16.920J)

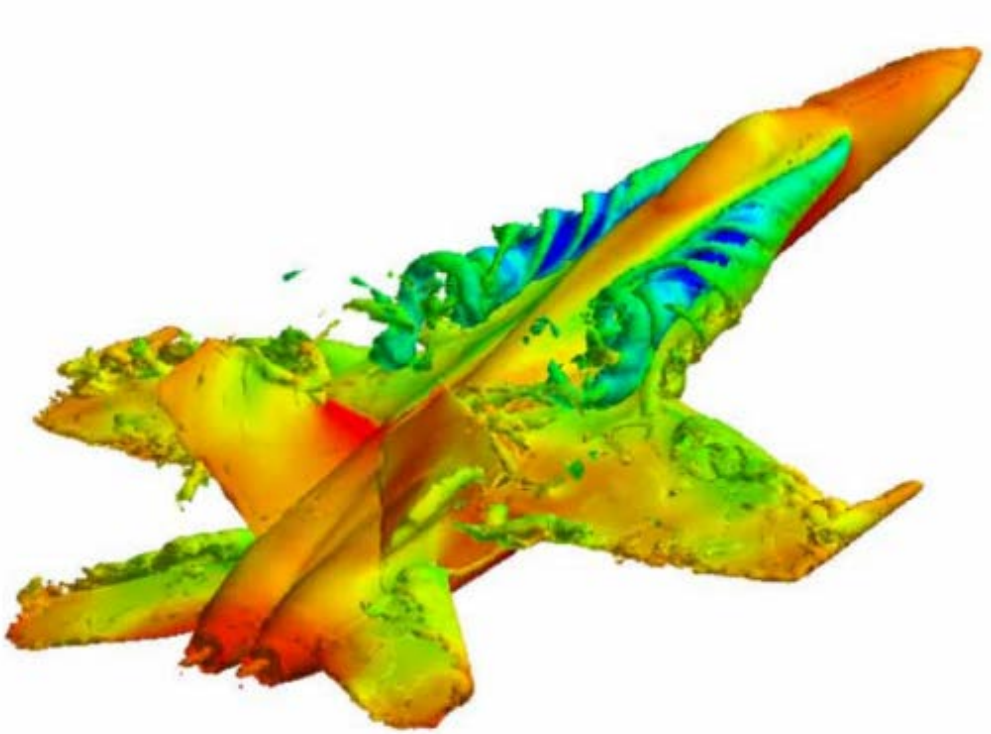
Lecture: MW(F) 9:30-11:00am, Bldg 4-136

Units 3-0-9, Grad H-level Credit

Prof. Qiqi Wang

Prof. Jacob White

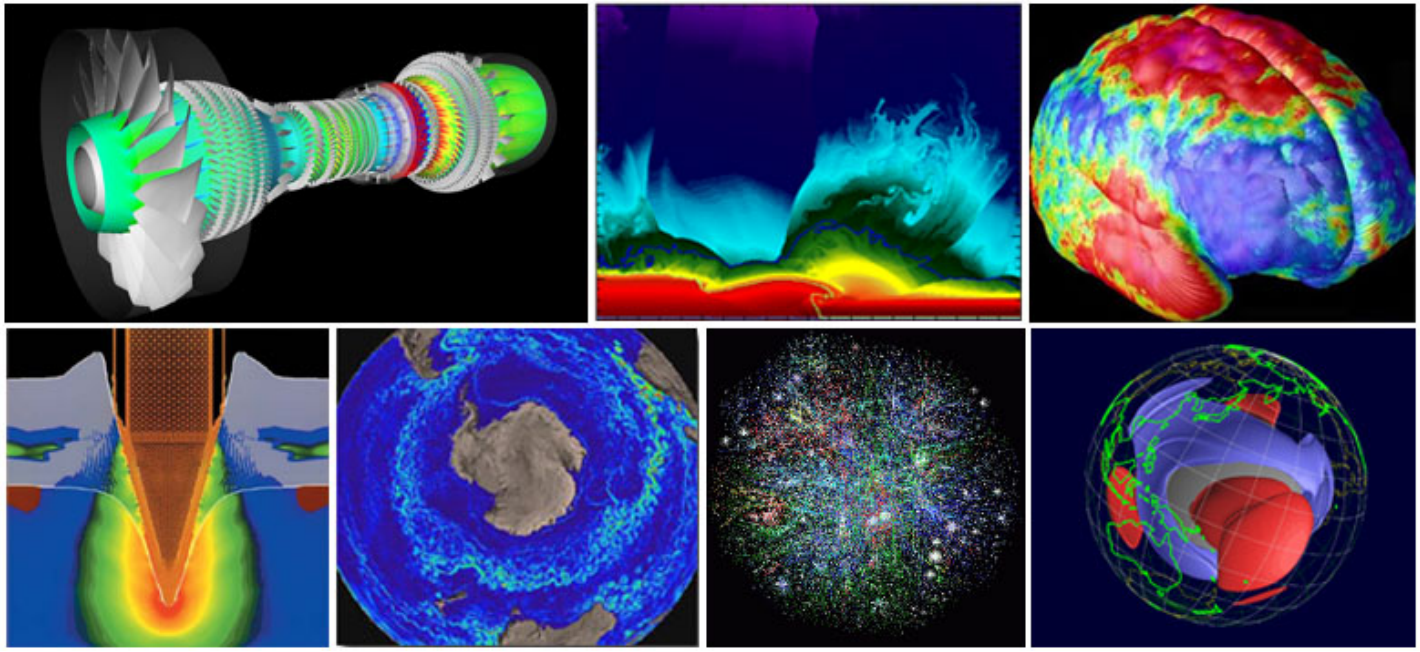
F-35 buffets



Numerical solution of PDEs reveals why aircrafts buffet

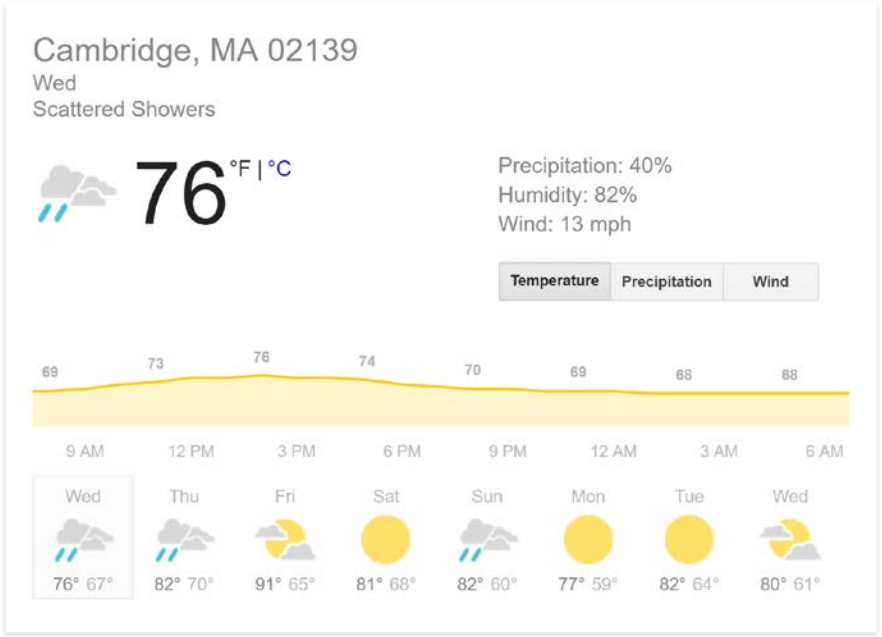
What this class is about

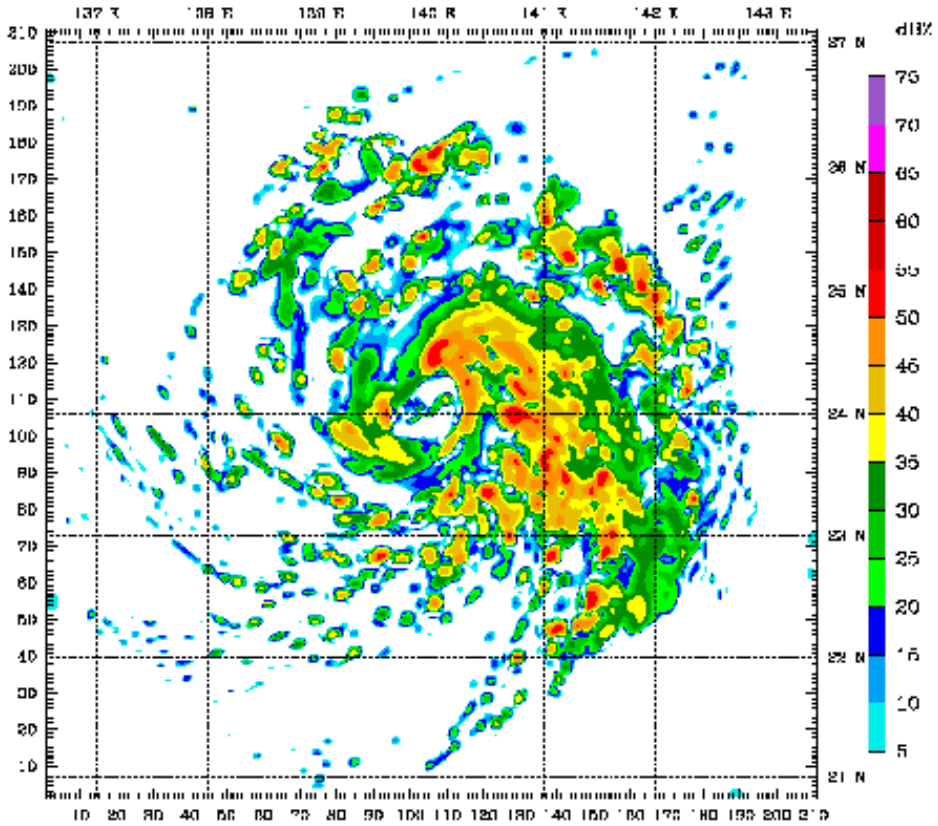
Modern numerical techniques for a **wide range of PDEs**, useful in many science and engineering applications



What this class is about

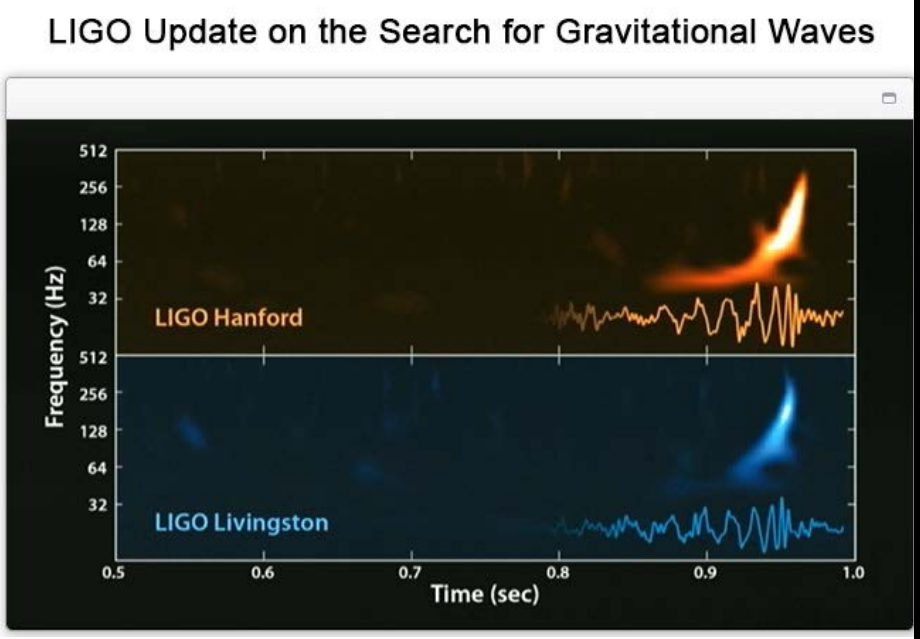
Modern numerical techniques for a **wide range of PDEs**, useful in many science and engineering applications

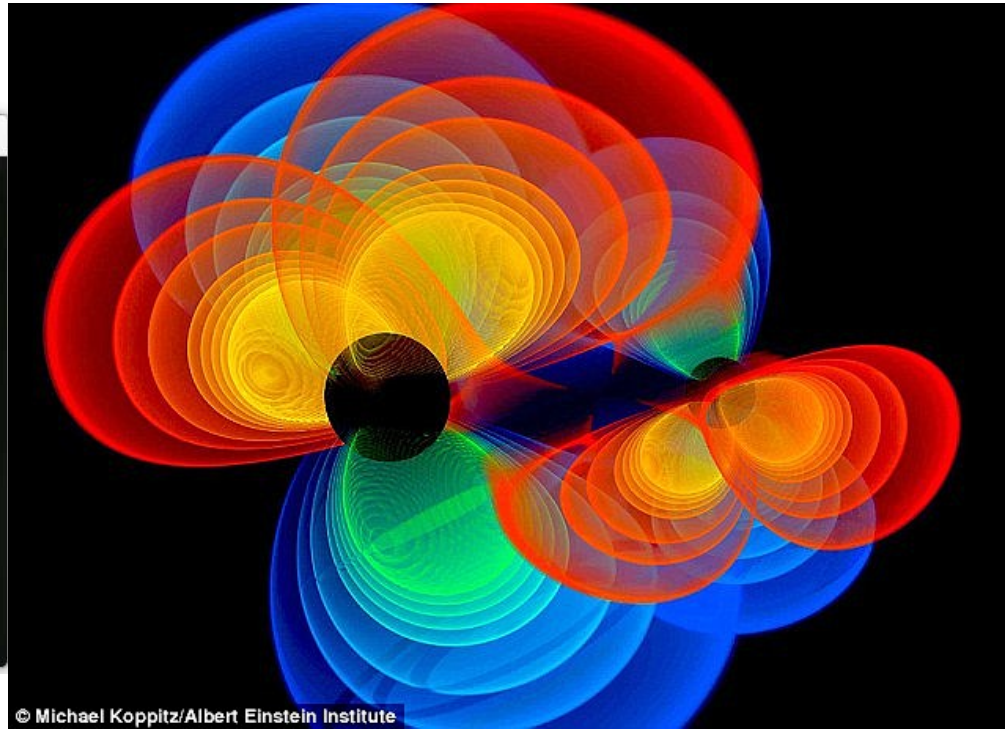




What this class is about

Modern numerical techniques for a **wide range of PDEs**, useful in many science and engineering applications





Today, President Obama issued an Executive Order establishing the National Strategic Computing Initiative (NSCI) to ensure the United States continues leading in this field over the coming decades. This coordinated research, development, and deployment strategy will draw on the strengths of departments and agencies to move the Federal government into a position that sharpens, develops, and streamlines a wide range of new 21st century applications. It is designed to advance core technologies to solve difficult computational problems and foster increased use of the new capabilities in the public and private sectors.

As an example, Computational Fluid Dynamics (CFD) has been an important tool in aircraft design since the 1970s. Through CFD simulations, the aircraft industry has significantly reduced the need for wind tunnel and flight testing, but current technology can only handle simplified models of the airflow around a wing and under limited flight conditions. A recent study commissioned by NASA determined that machines able to sustain exaflop-level performance could incorporate full modeling of turbulence, as well as more dynamic flight conditions, in their simulations.

What this class is about

Modern numerical techniques for a **wide range of PDEs**, useful in many science and engineering applications

- **Finite Difference**
- **Finite Volume**
- **Finite Element**
- **Boundary Element**
- **Direct and Iterative Solution Methods**
- **Error Analysis and Sensitivity Analysis**

NO EXAMS, NO PSETS – but…

Expect lots of **coding and debugging**

Prerequisites: **Linear algebra, ODE, MATLAB**

Eight project Sets:

- Finite Difference projects 18 %
- Finite Volume projects 18 %
- Finite Elements projects 18 %
- Boundary Element projects 18 %
- Custom designed project 28 %

Collaboration Policy on Learning Modules

QUESTIONS?