**Briefly describe what you are petitioning for and why:**

The course will serve as an introduction to the field of computational fluid dynamics (CFD), with an emphasis on combustion and turbulence using basic and advanced concepts of numerical methods for discrete approximations. The course will consist of a semester long project using the CFD solver CONVERGE and incorporate proprietary and open source software including but not limited to Cantera, Matlab, and Paraview. Currently, there are no classes in the Department of Mechanical Engineering specifically focused on CFD or computational combustion.

**Duration**

The course will take place over the spring 2018 semester, lasting a total of 17 weeks.

**Background**

Current computational modeling involves complex numerical solvers to capture physical flow phenomena. CONVERGE is an industry standard solver for internal combustion engines, and will be coupled with Cantera, a chemical kinetics software, to simulate advance reacting flow. This class will provide experience for future work in the areas of alternative and bio fuels.

**Description of the project**

This course will primarily be project based. Using the commercial CFD solver CONVERGE, a laminar reacting flow case will be studied to observe fundamental numerical flow characteristics. This simulation will then be compared to experimental results, available through Sandia National Laboratory database. The project will culminate in turbulent reacting flow simulations of the same case.

**Learning Objectives**

The goals of course are the following:

* + 1. A foundational understanding of the conservation equations needed for reacting flows and issues which arise from numerical resolution of the Navier Stokes equations for a multi-species reacting flow.
    2. An introduction to numerical methods for laminar premixed flames.
    3. An introduction of laminar diffusion flames including concepts associated with such flames: mixing fractions and scalar dissipation.
    4. To study flame/boundary interaction.
    5. To study turbulent premixed flames in RANS, LES, and DNS cases.

**Organization**

Every three weeks a new topic will be introduced, these will align with the learning objectives as well as the topics relevant to the project. Weekly meetings will be held with the independent study advisor, Prof. Peter Hamlington

**Reference Materials**

Textbook – Theoretical and Numerical Combustion, Second Edition

ISBN – 1-930217-10-2

**Deliverables at end of project**

The final deliverables will include four scientifically formatted progress reports, as well as a final project report and abstract. Each report is intended to cover the relevant learning objectives as well as an update on the progress of the project. In addition to the written reports, performance reviews will be held on a regular basis. These meetings will be primarily to review the written reports and provide feedback.