Undergraduate Research Fellowship Competition

The Engine Research Center (ERC) at the University of Wisconsin-Madison is a world-class research facility dedicated to furthering the knowledge of the thermofluid aspects of internal combustion engines. The ERC is internationally recognized for both experimental and computational (CFD) research.

A new fellowship competition is being offered to allow undergraduates to be involved in the research activities of the ERC. If desired this can be incorporated into your degree program as an independent study project. It is anticipated that the successful applicant will be paired with a current graduate student (to help facilitate day-to-day needs) and a faculty advisor.

The ERC undergraduate research fellowship (URF) provides a stipend of $500 to the student, and makes available up to $500 for research supplies.

Application Procedure:

Applications will be due October 29, 2003 and winners will be announced by November 7, 2003. The application will consist of a 3 page (maximum) research proposal and a current resume and transcript. The proposal should: identify an area requiring further study, include relevant background material, and provide details of the proposed investigation.

A list of projects suggested by the ERC faculty can be acquired from Prof. Ghandhi (rm. 125 ERB, ghandhi@engr.wisc.edu). Additionally, ERC faculty are interested in hearing your project ideas.

It is expected that the work will be performed either during the semester break or during the spring semester. The culmination of the work will be a short presentation made at a bi-weekly Engine Research Center seminar.
Visualizing Combustion in High Speed Automotive Diesel Engines (Prof. Reitz)
Recent advances in computer graphics software make it possible to visualize engine combustion processes predicted by detailed models in unprecedented detail. This project will apply these graphics models to help analyze combustion in a high speed automotive Diesel engine that is being studied as part of a collaboration with the Sandia National Laboratories. The computer graphics results will be compared with experimental images taken of the in-cylinder combustion processes at Sandia.

Fractal Description of Engine Flames and Passive Scalar Mixing (Prof. Ghandhi)
A fractal dimension can be used to describe wrinkled surfaces that obeys certain scaling laws, and has been successfully used to described premixed engine flames. The objective of this project is to determine the fractal dimension of engine flames from existing data that was acquired under both homogeneous and stratified engine operation. Time permitting, the same procedure will be applied to existing passive scalar mixing data.

Development of a Robust Injector Patternation Device (Prof. Ghandhi)
The spray pattern of an injector is critical to the operation of spray-guided direct-injection gasoline engines, with injector-to-injector variations causing significant problems. The objective of this project is to develop a robust testing chamber that provides optical access and is capable of operating at elevated pressures. The major effort will be developing a system to minimize the fouling of the windows since the device is intended for production quality control.

Laser Measurements of High-Temperature, High-Pressure H₂O Contained in a Heated Cell (Prof. Sanders)
We are using lasers to measure the properties of H₂O produced in engines. We often need to compare our engine measurements to measurements of H₂O at known conditions. We have designed a heated sapphire gas cell for this purpose. This project will involve constructing the cell and testing it using laser equipment in the ERC.

Mid-infrared Spectrometer (Prof. Sanders)
Commercial instruments exist for characterizing the spectrum of light (power versus wavelength) in the 300 - 1700 nm range. This range encompasses the ultraviolet, visible, and near-infrared portions of the spectrum. We are beginning to work with lasers and light sources that produce light at wavelengths > 1700 nm, known as the mid-infrared, and we need an instrument for characterizing these devices. This project will involve constructing and testing a simple mid-infrared spectrometer that composed of a rapidly spinning prism and a detector.

Modeling Diesel Aftertreatment Devices (Profs. Rutland and Foster)
In the near future diesel engines will be required to have soot filters and NOx catalyst to reduce exhaust emissions. The ERC is currently very active in developing simulation models for these devices. In this project, the student will use MATLAB/Simulink to build a simple model for a diesel particulate filter that includes regeneration sub-models. The student will work with a team of graduate students working on other models for diesel aftertreatment.

Carburetor Modeling (Prof. Shedd)
The fellow will assist in the development of a model for fuel and air flow through a small engine carburetor using Fluent to perform computational fluid dynamics simulations. Simulations of simple orifices will first be performed and verified experimentally. Then the more complex geometries of actual fuel jet orifices will be simulated and verified. Finally a parametric study of entrance, exit and channel geometries will be performed computationally to establish a general correlation for the discharge coefficient of the fuel jet. Time permitting, a similar study will be performed on carburetor venturis.

ERC Faculty and Staff

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