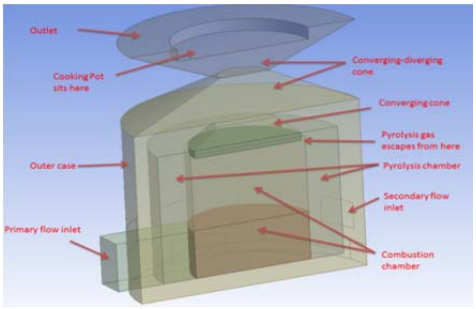
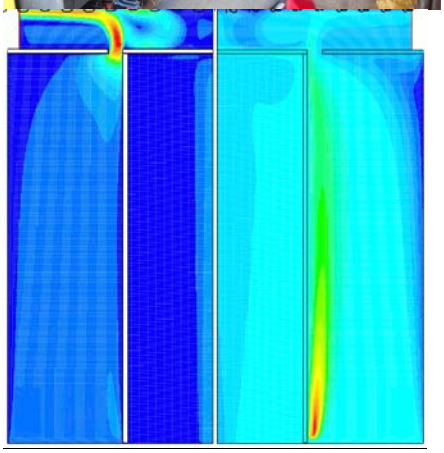
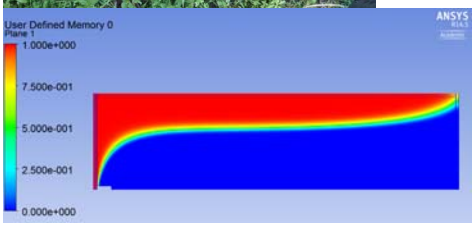
Sustainable Energy Cookstove Producing Biochar: Modeling, Testing, and Design







I am looking for 1-3 students to join work on the modeling, design, and testing of cookstoves for use in developing countries. In recent years, there has been much interest in designing improved cookstoves for use in developing countries. Improvements have focused on reducing harmful emissions and improving efficiency. We use numerical modeling to improve the heat transfer and fluid flow in the stove. We also consider factors that make the stove convenient to use, safe, and economical. We are starting to develop a collaboration with several Mexican universities and will probably have a Mexican student visiting our group and learning about our simulation techniques.

The project originated as part of a large project based in Soil and Crop Sciences, focusing on stoves that produce "biochar" or charcoal from biomass as a beneficial soil additive. The stove developed with Soil and Crop Sciences was tested in 30 households in Kenya in 2013, and our collaborators from UC Irvine are currently processing data from measurements of air pollutant levels in those households. For 2016, we plan several complementary activities: 1) improving numerical models of the complex heat transfer, chemical reactions, and fluid flow in the stove for better design of the Kenya stove 2) developing numerical models of alternative stove designs, e.g. the Patsari cookstove developed in Mexico 3) investigating the relationships between pollutant emissions and operating conditions for different stove designs.

Students with an interest in numerical modeling with commercial software can contribute, as can people who are interesting in designing, instrumenting, and testing a prototype cookstove. **I have a preference for students wishing to start a 2-semester project for Spring 2016 and Fall 2017.** Depending on the choice of project, work on the cookstove project can be used for M. Eng. or senior design credit, or as independent study (MAE 4900).

DESIRED QUALIFICATIONS: familiarity with heat transfer, fluid mechanics, thermodynamics, and basic chemistry. Desirable, but not necessary: experience with FLUENT, CFX, or COMSOL software, hands-on lab work, coursework in combustion or numerical modeling, knowledge of Labview and Matlab.

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