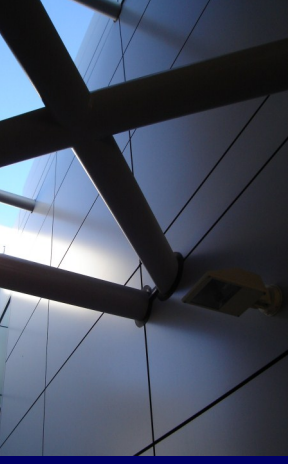

MECHANICAL ENGINEERING

The Department of Mechanical Engineering presents:

The Master's Dissertation Defense of:

Jing Li

Department of Mechanical Engineering
Advisor: Professor Shankar Mahalingam

Monday, November 29th, 9:30 a.m.
EBU II 202

Experimental Investigation of Bulk Density and its Role in Fire Behavior in Live Shrub Fuels

Wild land fires occur in Southern California every year and frequently cause damage in excess of millions of US dollars to urban household, farmland, forests and even wilderness areas. This thesis examines the role of bulk density on fire behaviour in live shrub fuels. This includes an investigation of shrub bulk density distribution in the vertical, effects of the influence of bulk density variation on fire behaviour, and the influence of wind and ignition method on fire dynamics. The results of the study will help improve the understanding of the effects of variation in live fuel bulk density on fire behaviour by suggesting models to investigate some features that have not been adequately considered in previous studies.

The approach used in this research is a combined experimental-numerical study. Results indicate that for relatively young Chamise and Manzanita (0-4 years), the bulk density appears differently distributed. It is expected that fire behaviour would change when varying bulk density, wind speed and ignition method. Three bulk density cases including low, mean, and high bulk density were investigated to study response to ignition method and resulting fire behaviour. Statistical T-test was used to analyse the effects these parameters and variance error. Low bulk density means the shrub contains less overall mass and fuel energy in a specific volume. However, experiments show that the fire spread rate was not decreased when compared to the mean bulk density case where energy and mass contained is relatively higher than the low bulk density case. The flame propagates faster for the same wind speed and ignition method because of enhanced entrainment of air into the flame zone. Large eddy simulation (LES) simulation results show that the total burning time for the low bulk density case is significantly lower than mean and high bulk density cases.