ENFP425 Enclosure Fire Modeling

Credits: Three (3)

Contact hours: Two lectures per week, 75 minutes each.

Table 5-1 category: Engineering topic

Instructor: Stoliarov

Textbook: Karlsson B., Quintiere J. G., *Enclosure Fire Dynamics*, CRC Press LLC, 2000.
Other supplemental materials: SFPE Handbook of Fire Protection Engineering, 5th Edition, M. Hurley (ed), New York: Springer, 2015.

Catalog description:
An introduction to enclosure fire dynamics through the development of fire modeling algorithms and the application of computer-based fire modeling techniques. The objectives of the course are: to provide a basic understanding of enclosure fire dynamics with an emphasis on a system-level viewpoint (i.e., a global description of the coupling between combustion dynamics, smoke filling, vent flows and heat transfer); and to provide an introduction to the zone modeling approach. Topics covered include a review of the mathematical formulation of zone models, a discussion of numerical integration of the zone modeling equations (using MATLAB), and an introduction to zone modeling software used by professional engineers (e.g., CFAST).

Prerequisites and Corequisites:
Prerequisite: ENFP312.

Table 5-1 Course Type: Required

Specific outcomes of instruction:
Upon completion of this course, students should be able to:
- Demonstrate understanding of main stages of compartment fire.
- Identify different regimes of fire development and apply mass and energy conservation statements to compute changes in temperature, pressure and composition of gases in the compartment.
- Compute mass flows associated with fire plume and compartment vents and optimize performance of a smoke management system.
- Develop MATLAB programs that can be used to solve systems or ordinary differential equations describing evolution of fire in a compartment.

Student outcomes assessed: SO1, SO7

Brief list of topics covered:
- Fire growth: formation of a smoke layer and transition to flashover.

- Mass and energy conservation and application in zone models.
- Fuel-limited and oxygen-limited combustion regimes and species yields.
- The concept of design fire.
- Vent flows, natural ventilation theory, smoke transport in buildings.
- Convective heat transfer, radiation exchanges between gray surfaces in enclosures, wall heat losses.