

ENFP426 Computational Methods in Fire Protection Engineering

Credits: Three credits, two one-hour-and-a-half lectures weekly

Instructor: Arnaud Trouvé

Textbook: No textbook but a list of references:

1. Karlsson, B., and Quintiere, J.G., *Enclosure Fire Dynamics*, CRC Press LLC, 2000
2. DiNenno, P.J. (Ed.), *SFPE Handbook of Fire Protection Engineering* (4th Edition), National Fire Protection Association, Quincy, MA, 2008, or DiNenno, P.J. (Ed.), *SFPE Handbook of Fire Protection Engineering* (5th Edition), National Fire Protection Association, Quincy, MA 2016.
3. CFAST
 - <https://pages.nist.gov/cfast/>
 - Peacock, R.D., Reneke, P.A., Forney G.P. (2016) “*CFAST - Consolidated Model of Fire Growth and Smoke Transport (Version 7) – Volume 2: User’s Guide*”, NIST Technical Note 1889v2.
4. FDS
 - <https://pages.nist.gov/fds-smv/>
 - McGrattan, K., Hostikka, S., McDermott, R., Floyd, J., Weinschenk, C., Overholt, K., “*Fire Dynamics Simulator – User’s Guide*,” NIST Special Publication 1019, Sixth Ed., National Institute of Standards and Technology, Gaithersburg, MD, USA, 2016.
 - McGrattan, K., Hostikka, S., McDermott, R., Floyd, J., Weinschenk, C., Overholt, K., “*Fire Dynamics Simulator (Version 6) – Technical Reference Guide, Volume 1: Mathematical Model; Volume 2: Verification; Volume 3: Validation; Volume 4: Configuration Management*” NIST Special Publication 1018, Sixth Ed., National Institute of Standards and Technology, Gaithersburg, MD, USA, 2016.

Specific course information:

1. Catalog Description: Introduction to computer-based fire modeling: zone modeling and Computational Fluid Dynamics (CFD); documentation of input data, validation and verification tests
2. Prerequisites: ENFP425
3. Required Course

Specific goals for the course:

1. Upon completion of this course, students should be able to:
 - Understand zone and CFD modeling approaches used by professional engineers to simulate fire phenomena
 - Use some of the leading fire modeling software products used by professional engineers to simulate fire phenomena
 - Develop analytical skills for verification and validation (V&V) of simulation results from fire modeling software
 - Develop analytical skills for interpretation of simulation results from fire modeling software

2. This course focuses on two SOs:
 - SO4 - An ability to function on multidisciplinary teams.
 - SO7 - An ability to communicate effectively.

Brief list of topics:

- Introduction to computer-based fire modeling and comparison between the zone modeling and CFD modeling approaches
- Quality control tests: Verification and Validation
- Introduction to zone modeling software used by professional engineers (CFAST)
- Introduction to CFD modeling software used by professional engineers (FDS)
- Series of case studies: the students use zone and CFD models to simulate different representative fire problems, including configurations featuring smoke transport, fire spread, flashover and under-ventilated fires, thermal radiation transport, fire detection and sprinkler activation