

## ENFP426 Computational Methods in Fire Protection

*Credits:* Three (3)

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

*Table 5-1 category:* Engineering topic

*Instructor:* Trouvé

*Textbook:* N/A

*Other supplemental materials*

1. Karlsson, B., and Quintiere, J.G., *Enclosure Fire Dynamics*, CRC Press LLC, 2000
2. SFPE Handbook of Fire Protection Engineering, 5<sup>th</sup> Edition, M. Hurley (ed), New York: Springer, 2015.
3. CFAST
  - <https://pages.nist.gov/cfast/>
  - Peacock, R.D., Reneke, P.A., Forney G.P. (2022) “*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., Floyd, J., McDermott, R., Vanella, M., “*Fire Dynamics Simulator – User’s Guide*,” NIST Special Publication 1019, Sixth Ed., National Institute of Standards and Technology, Gaithersburg, MD, USA, 2022.
  - McGrattan, K., Hostikka, S., Floyd, J., McDermott, R., Vanella, M., “*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, 2022.

*Catalog description:*

Introduction to computer-based fire modeling: zone modeling and Computational Fluid Dynamics (CFD); documentation of input data, validation and verification tests.

*Prerequisites and Corequisites:*

Recommended: ENFP425. Restriction: Permission of ENGR-Fire Protection Engineering department.

*Table 5-1 Course Type:* Required

*Specific outcomes of instruction:*

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

*Student outcomes assessed:* SO3.1, SO5.1, SO7

*Brief list of topics covered:*

- 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 and PyroSim).
- 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.