Computer Models
For
Fire and Smoke

Model Name: Fire Dynamics Simulator (FDS)

Version: 6.0.0

Date: September 2013

Classification: Computational Fluid Dynamics (CFD)

Very Short Description: Fire Dynamics Simulator (FDS) is a large-eddy simulation (LES) code for low-speed flows, with an emphasis on smoke and heat transport from fires.

Modeler(s), Organization(s): National Institute of Standards and Technology
VTT Technical Research Centre of Finland

User's Guide: K. McGrattan, S. Hostikka, R. McDermott, J. Floyd, C. Weinschenk, and K. Overholt. Fire Dynamics Simulator, User's Guide. National Institute of Standards and Technology, Gaithersburg, Maryland, USA, and VTT Technical Research Centre of Finland, Espoo, Finland, sixth edition, September 2013.

Technical References: K. McGrattan, S. Hostikka, R. McDermott, J. Floyd, C. Weinschenk, and K. Overholt. Fire Dynamics Simulator, Technical Reference Guide. National Institute of Standards and Technology, Gaithersburg, Maryland, USA, and VTT Technical Research Centre of Finland, Espoo, Finland, sixth edition, September 2013. Vol. 1: Mathematical Model; Vol. 2: Verification Guide; Vol. 3: Validation Guide; Vol. 4: Configuration Management Plan.

Validation References: K. McGrattan, S. Hostikka, R. McDermott, J. Floyd, C. Weinschenk, and K. Overholt. Fire Dynamics Simulator, Technical Reference Guide, Volume 3: Validation. National Institute of Standards and Technology, Gaithersburg, Maryland, USA, and VTT Technical

Research Centre of Finland, Espoo, Finland, sixth edition, September 2013.

Availability: http://www.fire.nist.gov/fds

Model Actively Supported?: Yes

Price: Free

Necessary Hardware: Windows, Mac OSX, Linux operating systems. CPU speed and memory depend on the size of the calculation.

Computer Language: Fortran 2003

Size: Case dependent

Contact Information: Kevin McGrattan

Detailed Description: FDS is a CFD model designed for thermally-driven flow simulations, in particular fire. Some of the major features of the model, in its default operation, are:

- Low Mach, large-eddy simulation (LES)
- Explicit, second-order, kinetic-energy-conserving numerics
- Structured, uniform, staggered grid
- Simple immersed boundary method for treatment of flow obstructions
- Generalized "lumped species" method (simplified chemistry using a reaction progress variable)
- Deardorff eddy viscosity subgrid closure
- Constant turbulent Schmidt and Prandtl numbers
- Eddy dissipation concept (fast chemistry) for single-step reaction between fuel and oxidizer
- Gray gas radiation with finite volume solution to the radiation transport equation

The model, however, is not limited to these simple algorithms. For example, the user may specify multiple reactions, finite-rate chemistry, a wide-band radiation model, and a variety of other special features. The more detailed physics incur increased computational cost and it is incumbent on the user to justify the added expense in terms of improved accuracy for a particular application. The default model options have been selected based on results from a wide variety of full-scale validation experiments