Computer Models
For
Fire and Smoke

Model Name:	SOFIE
Version:	3
Classification:	Field Model
Very Short Description:	*SOFIE* (Simulation of Fires in Enclosures)
Modeler(s), Organization(s):	Dr. P. Rubini, Cranfield University, UK
User's Guide:	*SOFIE* Version 3 Manual (available with distribution)
Technical References:	*SOFIE* Version 3 Manual (available with distribution)
Validation References:	M. Aksit, P. Mackie, P.A. Rubini. "Coupled Radiative Heat Transfer and Flame Spread Simulation in a compartment", Third International Seminar on Fire and Explosion Hazards, April 2000, Windermere, UK M.J.Lewis, J.B.Moss, P.A. Rubini. "Field Modelling of Non-Charring Flame Spread", Sixth Int Symp on Fire Safety Science, Poitiers, France, 1999. V.Sanderson, P.A.Rubini, J.B.Moss. "The effect of vent size of a compartment fire: Numerical simulation and validation". Proceedings of the Eight International Conference - INTERFLAM'99. Interscience Communications Ltd., 1999. ISBN 0-9532312-1-6 P.A. Rubini, J.B. Moss, "Coupled soot and radiation calculations in compartment fires". Proceedings of the Second International Conference on Fire Research and Engineering, Gaithersburg, Maryland, USA. August 1997, Society of Fire Protection Engineers, Bethesda, MD, USA M.J. Lewis, J.B. Moss, P.A. Rubini. "CFD modelling of combustion and heat transfer in compartment fires".

Proceedings of 5th International Symposium on Fire Safety Science, Melbourne, Australia, March 1997, International Association for Fire Safety Science, ISBN 4-9900625-5-5.

P.A. Rubini. "SOFIE - Simulation of Fires in Enclosures", Proceedings of 5th International Symposium on Fire Safety Science, Melbourne, Australia, March 1997, International Association for Fire Safety Science, ISBN 4-9900625-5-5

Availability: License agreement, see http://www.cranfield.ac.uk/sme/sofie

Price: Site license for research use only £100, commercial licenses available.

Necessary Hardware: Win9x/NT/2000, Unix (Sun Solaris, Compaq Alpha), Linux (Intel)

Computer Language: Fortran / C

Size: Problem specific

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Detailed Description:

SOFIE is a field modelling code based upon the solution of the Reynolds averaged Navier-Stokes equations using a finite volume approach and utilising an underlying general non-orthogonal coordinate system with co-located velocities, momentum smoothing and a pressure correction algorithm (single block, structured grid). Dependent variable interpolation is achieved using either a first order scheme (Hybrid or Power Law) or a TVD based second order accurate scheme. Turbulent closure is effected through a two equation, k-ε model incorporating buoyancy modifications. Alternative turbulence models are also available. Combustion is simulated using either an eddy breakup model or a prescribed pdf laminar flamelet based model. Thermal radiation is simulated using the discrete transfer radiation model with gaseous optical properties described by a weighted sum of grey gases model. Soot formation is represented by either a simple transported scalar or a pdf laminar flamelet description of the nucleation, coagulation, surface growth and oxidation phenomena. A number of phenomenologically based flame spread models are available which relate the rate of volatile release to incident heat flux including a simple linear relationship using a prescribed heat of gasification; the use of cone calorimeter data to characterise the material; tracking the pyrolysis front through the solid material through an internal energy balance.