Computer Models For Fire and Smoke

Model Name:	KOBRA-3D
Version:	KOBRA-3D Version 6.0
Classification:	Field Model
Very Short Description:	Three-dimensional CFD model for complex geometries to be used for smoke spread and heat transfer analyses
Modeler(s), Organization(s):	Dr. Volker Schneider, I.S.T. Integrierte Sicherheits-Technik GmbH, Frankfurt / M., Germany
User's Guide:	KOBRA-3D – Users' Guide (hardcopy and complete online documentation – available in German and English)
Technical References:	KOBRA-3D – Technical Reference (hardcopy and complete online documentation – available in German English version under preparation) Internal Technical Notes
Validation References:	V. Schneider, J. Hofmann: Feldmodell-Simulation von Kohlenwasserstoff-Raumbränden und Sprühnebel-Löschversuchen, vfdb-Zeitschrift 2 (1993) 67 V. Schneider, R. Könnecke: Anwendung des Feldmodells KOBRA-3D zur Simulation von komplexen Brandszenarien auf Fragestellungen der automatischen Brandentdeckung, 10. Int. Konf. über Automatische Brandentdeckung AUBE'95, 4.-6. April 1995, Duisburg, Germany V. Schneider: Aussagefähigkeit von Feldmodell-Simulationsrechnungen im Vergleich mit Modell- und Realversuchen hinsichtlich einer Bewertung der Personensicherheit, VdS-Fachtagung Ingenieurmäßige Verfahren im Brandschutz, 27. April 1999, Köln, Germany

V. Schneider, S. Löffler, C. Steinert, E. Wilk: Application of the compartment fire CFD model KOBRA-3D in fire investigation, Proceedings Interflam ’99, Fire Science & Engineering Conference, Edinburgh 1999

V. Schneider: Reconstruction of experimental and actual fires in enclosed spaces using numerical simulation techniques, International Congress on Fire Safety in Hazardous Enclosed Spaces, 8./9.11.1999, Vernon, France

V. Schneider, R. Könnecke: Evaluation of design fire scenarios – Numerical simulation vs physical modelling, Proceedings Interflam2001, Fire Science & Engineering Conference, Edinburgh 2001

V. Schneider: Mathematical and physical modelling of smoke spread in atria-type experimental set-ups, Proceedings Interflam2007, Fire Science & Engineering Conference, Royal Holloway University of London, 2007

Availability: I.S.T. Integrierte Sicherheits-Technik GmbH, Feuerbachstr. 19, 60325 Frankfurt / M., Germany, Phone (069) 72 11 68, Fax (069) 72 11 94, v.schneider@ist-net.de

Price: 16 800.- Euro (not including VAT, including hotline service and training)

Necessary Hardware: PC (at least Pentium III), Windows 2000 / NT / XP, Vista

Computer Language: C++

Size: Approximately 10MB of disk space, at least 256MB of RAM required, disk space for data output depending on scenario and type of output (e.g. number of restart files)

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Detailed Description:

The development of KOBRA-3D was initialised within a joint German-Norwegian research project to study enclosed hydrocarbon pool fires offshore. Since then KOBRA-3D has been extended to describe fire and smoke spread in complex geometries. The CFD and fire modelling software of KOBRA-3D is embedded into a user surface with 2D and 3D visualisation tools, material data base and help functions assisting the user in generating the mesh and defining additional required computational parameters.

KOBRA-3D is based on the solution of the three-dimensional time-dependent local hydrodynamic conservation laws obtained by a modified version of the well-known SIMPLE algorithm, including various sub-models for e.g. turbulence modeling (LES model), heat transfer analysis, flame modeling, detector response, fire gas - sprinkler interaction. A fire is described by a volumetric heat source with a prescribed time-dependent heat release rate for combustion-controlled burning, together with the respective yields of combustion products, mass optical density of smoke, effective heat of combustion and air consumption. Local fields of temperature, pressure, density, velocity components, optical smoke density and species concentration are calculated. Ventilation controlled fires are treated either by global oxygen consumption depending on the calculated air inflow at openings or by the calculated local oxygen concentration in the vicinity of the fire sources.