

# Models and Features

## GRID AND GEOMETRY OPTIONS

Fully autonomous meshing

Simulate moving boundaries with ease

Automatic grid generation at each time-step

Grid scaling

Fixed embedding

Adaptive Mesh Refinement

Inlaid meshing

Multi-stream meshing

Mesh import

Direct CAD import

Sealing of boundaries

## SOLVER OPTIONS

Transient solver (first-order explicit/implicit Euler, Crank-Nicolson)

Steady-state solvers (pseudo-transient, URS)

Multiple reference frame (MRF) approach with rotational correction

PISO or SIMPLE algorithm

Density-based or pressure-based

Stream-based for multi-physics simulations

2D axisymmetric solver

## DISCRETE PHASE MODELING

### LIQUID INJECTION

Blob

Injection distribution

Variable rate-shape

Hollow or solid cone

Discharge coefficient

VOF one-way coupling

ELSA

Urea models

### SPRAY BREAKUP

KH

RT

KH-RT

Modified KH-RT

KH-ACT

LISA

TAB

ELSA

### DROP TURBULENT DISPERSION

O'Rourke

TKE Preserving

LES

### DROP/WALL INTERACTION

Rebound/slide

Wall film

Splashing (O'Rourke, Kuhnke, Bai-Gosman)

Film separation

Film stripping

Adaptive film mesh

Wruck heat transfer

### DROP DRAG

Spherical drag

Dynamic drag

### COLLISION

O'Rourke

NTC

Adaptive collision mesh

### COLLISION OUTCOMES

O'Rourke

Post

### EVAPORATION

Multi-component vaporization

Discretized temperature model

### UREA DECOMPOSITION AND SCR

Molten solid

Multi-component

Detailed decomposition

Catalytic surface chemistry

Urea solidification model + deposit buildup

### SOLID PARCELS

Erosion modeling

Steady particle tracking

Parcel-wall interaction

Particle radiation

## COMBUSTION MODELS + CHEMISTRY OPTIONS

SAGE detailed chemical kinetics solver

SAGE with adaptive zoning

Thickened flame model

Three-point PDF

CEQ

G-Equation

Shell+CTC

LESI spark model

EDSI spark model

Eddy Dissipation Model

ECFM and ECFM3Z

RIF

FGM

Surface chemistry

0D and 1D tools

Reaction mechanism merging, tuning, and reduction

Fuel surrogate blender

Pathway flux analysis

Dynamic mechanism reduction

Skip species for combusting simulation speedup

## EMISSIONS MODELS

Thermal NOx  
Prompt NOx  
Hiroyasu-NSC soot  
Phenomenological soot  
Detailed soot (PM, PSM, SSM)  
Emissions post-processing

## TURBULENCE MODELS

### RANS

Standard k-epsilon  
RNG k-epsilon  
Rapid distortion RNG k-epsilon  
Realizable k-epsilon  
v2-f  
zeta-f  
Standard k-omega (1998)  
Standard k-omega (2006)  
k-omega SST  
Spalart-Allmaras  
Reynolds stress models

### LES

Upwind LES  
One-equation viscosity  
Smagorinsky  
Dynamic Smagorinsky  
Sigma LES  
Dynamic structure  
Consistent dynamic structure  
Two-equation

### HYBRID RANS/LES

Delayed DES  
Improved delayed DES  
Stress-blended eddy simulation (SBES)

### WALL MODELS

Standard law-of-the-wall  
Asymptotic  
Scalable  
Automatic  
Non-equilibrium  
Enhanced wall treatment  
Analytical wall function  
Werner and Wengle

### OTHER

User-defined functions (UDFs)  
GT-SUITE coupling  
CONGO genetic algorithm optimization  
Machine learning optimization  
Built-in post-processing  
In situ post-processing with ParaView Catalyst  
Cloud computing resources through CONVERGE Horizon

*\*Current as of CONVERGE version 4.1.0*

## EULERIAN MULTI-PHASE MODELING

Species-based volume of fluid modeling

Piecewise Linear Interface Calculation  
High Resolution Interface Capturing  
Flux-corrected transport  
Surface compression  
Drift flux model  
Dissolved gas  
Wind and wave modeling boundary conditions  
Species sub-cycling

Multi-Fluid Multi-Field (MFMF) modeling

Particle stress model for granular flows  
Porous media implementation for sub-grid geometries

Cavitation

Homogeneous relaxation model (HRM)  
Homogeneous mixture models (Schnerr and Sauer, Singhal, Saito)

## MULTI-PHYSICS MODELING

Conjugate heat transfer

Convection/conduction/radiation

Boiling models

Coupled electric potential solver

Equivalent circuit model

Battery thermal runaway (Hatchard-Kim, Ren)

Electromagnetic loss import

## FLUID-STRUCTURE INTERACTION MODELS

Rigid-body FSI with 6 degrees of freedom

Spring model  
Stiction model  
MRF + FSI  
Contact model  
Implicit FSI

1D models

Finite element beam  
Dynamic cable model

Membrane model

3D deformation

Abaqus co-simulation

## AEROACOUSTIC MODELS

Ffowcs Williams-Hawkings

Proudman

Curle

## ENGINEERING MODELS

Thin-gap model

Rotor models (ALM, RADM)

Porous media model

Fixed flow

Mixing planes

