TransAT

Release Notes

Version <version>

This document summarizes the latest developments brought into TransAT since the previous release.

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1.1 Rosseland Radiation model

The Rosseland radiation model can be used only for optically thick media (optical thickness ¿ 3). The model assumes that the effect of radiation can be taken into account as an effective temperature-dependent conductivity. Since no additional transport equation is solved, the Rosseland model does not impose significant additional overheads to include radiation effects.

1.2 Periodic Boundary Conditions

Periodic (cyclic) boundary conditions will copy the values of all variables at one boundary to the cells of the other boundary and vice-versa such that the solution becomes periodic. Cyclic BCs require careful setup and in general are applied to domains with simple geometries.

1.3 Multiphase Inputs for Pressure Forcing

When cyclic boundary conditions are used, a pressure source term can be added. Inputs are provided per phase, that each phase can have a unique pressure forcing magnitude and direction. Pressure forcing is defined either by a superficial velocity or a pressure gradient. Superficial velocity is the space-average velocity over the whole fluid domain while a pressure gradient directly sets the pressure source term.

1.4 Extensions to RANS turbulence models

1.4.1 Yap correction

The Yap correction consists of an additional source term of the form ρS_ε to the right hand side of the epsilon equation. The Yap correction is active in non-equilibrium flows and tends to reduce the departure of the turbulence length scale from its local equilibrium level. The correction improves results with the $k-\varepsilon$ model in separated flows.

1.4.2 Swirl correction

The turbulent eddy viscosity is corrected for strongly swirling flows because the standard $k-\varepsilon$ models tend to overestimate turbulent diffusion for swirling flows. The eddy viscosity is modified using a swirl correction factor.

1.4.3 Dilatation Dissipation Correction

The compressible dilatation dissipation correction accounts for the reduction in turbulence levels at moderate to high Mach numbers.

1.5 Marangoni effect

Surface tension can be made temperature-dependent (linearly) to simulate thermo-capillary convection using the level-set interface tracking method. Thermo-capillary or Marangoni convection could be important for surface tension and contact angle driven flows when thermal effects are present, for example in micro-fluidic systems.

1.6 Embedded Fan

The new UDF tool “Embedded Fan” allows the user to introduce the effect of a jet fan inside the simulated domain by means of a UDF. The fan flow rate is freely adjustable and can be set up to vary over time or in dependence on any other available simulation parameters or output.
While targeted towards ventilation problems this tool can also be used to introduce a customised round jet into any kind of simulation.

1.7 Fire Source

The new UDF tool “Fire Source” allows the user to introduce the effect of a fire inside the simulated domain by means of a UDF. The fire source is characterised by a specified heat output and a specified concentration production rate, meant to represent the release of smoke or other pollutants that behave like passive scalars inside the flow field.
The fire source can also be used as a generic, customisable distributed heat or concentration source.

1.8 Pressure Loss Coefficient for Pressure Outlets

A new pressure loss coefficient ζ parameter has been added to the pressure outflow options. This allows for the consideration of pressure losses downstream of the simulated domain, with respect to the bulk outflow dynamic head.

1.9 Paraview Results written as binary

Previous versions of TransAT wrote VTK files (for Paraview) in ASCII format. ASCII files are larger and slower to load when viewing in Paraview. By default, files are now written in Binary. The binary output files are now several times smaller in size and faster to load into Paraview. Output format can be chosen between Binary or ASCII in the User Interface.

1.10 Improvements exporting CAD to Mesh

CAD geometries can be added to and removed from the mesh without disrupting Blocks or Sub-BCs. Previous versions of TransAT would reset the domain to a single block and destroy Sub BCs if embedded surfaces were changed. Now, all blocks can be kept and Sub-BCs are not automatically destroyed. This improvement will further accelerate the creation of simulation setups.

1.11 Extension of accessible variables

Access to different arrays is possible through UDFs in TransAT. For the time-averaging feature (typically used for large eddy simulations (LES) and direct numerical simulations (DNS)), a number of one-point and two-point statistics are available in TransAT. Access to these statistics arrays through UDFs has been made available. This was not possible in earlier releases. More details are available in the User Manual.

1.12 Miscellaneous bug fixes and other improvements

- The cell volume is always included in the VTK output files for Paraview.

Chapter 2

Release 5.5: Changes

- Solver
  - Pressure gradient approximation for algebraic slip model (ASM)
  - Interphase drag, lift, and wall lubrication: set models between each phase combination
  - User Defined Functions for ASM: drag, lift, and wall lubrication models
  - UDF source terms: alpha-rho, mass fraction, pressure, concentration, epsilon, TKE
  - Access to concentration diffusivity in the properties module
  - Compressibility allowed with algebraic slip model
  - Information provided during simulation about ASM validity
  - New phase change model for cavitation
  - Heat capacity calculation from equation of state
- User Interface
  - Momentum transfer tables to define interphase models: drag, lift, and wall lubrication
  - New window for UDFs: writing, compiling and executing UDFs
  - Templates for UDFs
  - Creation of advanced initial conditions in the initial conditions window

Chapter 3

Updates Since 5.3

- Solver
  - Structure of UDFs improved
- User Interface
  - Improvements to graphical layout and organization
  - Initialization of advanced initial conditions in execute window
  - Fix for activation and loading of gravity