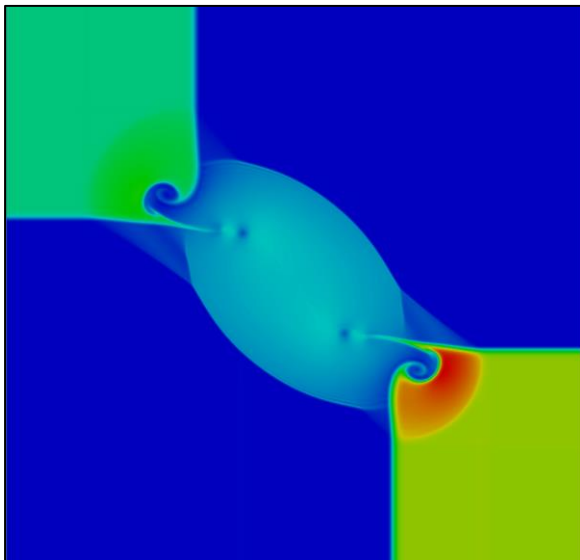


Version 5.10 (October 26, 2015)

Solvers

Compressible

- `cpbnsLTS`: primitive variable solver suitable for all Mach number flows with numeric flux based on Mach number scaling. Time marching scheme based on local time stepping (LTS) scheme applicable for steady state computations.
- `cpbnsPIMPLE`: primitive variable solver suitable for all Mach number flows with numeric flux based on Mach number scaling. Time marching scheme based on PIMPLE algorithm suitable for time accurate computations.
- `dbnsExplicitSolver`: density based solver for compressible subsonic and supersonic flows. Includes run-time selectable numeric fluxes based on approximate Riemann solvers for upwind and central schemes. Time marching is based on four stage low storage Runge-Kutta scheme. Includes Barth-Jespersen and Venkatakrisnan multi-dimensional limiters.



Density contours from 2D Riemann problem solution using `cpbnsLTS` compressible solver in Caelus v5.10

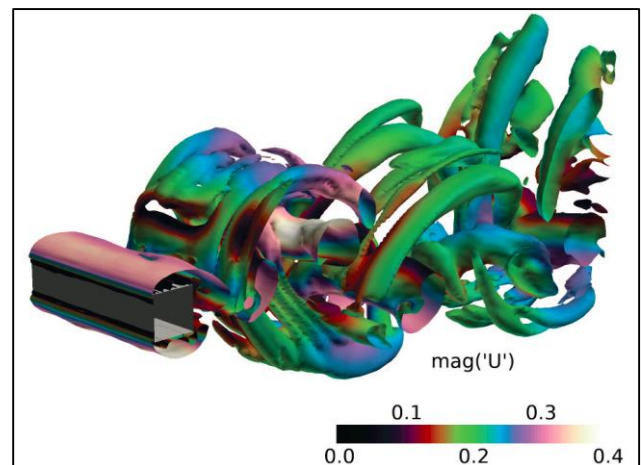
Multi-phase

- `vofLPTSolver`: transient, Volume of Fluid (VOF) solver with Lagrangian particle tracking

Models

Turbulence

- `VLESModel`: a delayed two equation very large eddy simulation (VLES) model based on three length scales. A resolution control function is used to rescale the Reynolds stresses based on the ratio of the resolved to unresolved turbulence spectrum.
- `coherentStructure` LES: the coherent structure model based on Kobayashi et al¹ is a local subgrid-scale (SGS) model which does not average in homogeneous directions.
- Compressible variants for all existing incompressible turbulence models were added.



Iso-surfaces of Q-criterion from flow over square cylinder colored by velocity magnitude using VLES turbulence model in Caelus v5.10. Stephens et al., "A two equation VLES turbulence model with near-wall delayed behaviour", APISAT 2015

Library enhancements

Discretization

- New TVD central schemes based on Barth-Jespersen, Koren, and Venkatakrisnan limited interpolations.

¹ International Journal of Heat and Fluid Flow 29 (2008) 640–653

Updated Function Objects (complete list)

- **Plotting data during simulation**
 - `cellSource`: operate on cell values
 - `faceSource`: operate on face values
 - `fieldMinMax`: write min/max values of fields
 - `fieldValue`: average/integrate on sets of faces/cells
 - `fieldValueDelta`: difference between two `fieldValue` function objects
 - `forces`: calculate pressure and viscous forces and moments
 - `forceCoeffs`: calculate lift, drag and moment coefficients
 - `probes`: extract values at points
 - `sampledSet`: extract values along lines
 - `regionSizeDistribution`: create a size distribution of continuous phase fraction
 - `residuals`: write initial residuals
- **Writing and reading data**
 - `calcFvcDiv`: calculate the divergence of a field
 - `calcFvcGrad`: calculate the gradient of a field
 - `calcMag`: calculate the magnitude of a field
 - `CourantNo`: write the Courant number
 - `DESModelRegions`: write an indicator field for DES turbulence models
 - `fieldAverage`: temporally average fields
 - `fieldCoordinateSystemTransform`: transforms fields to and from global and local coordinate systems
 - `Lambda2`: write `Lambda2`
 - `partialWrite`: allow registered objects to be written at specified times
 - `Peclet`: write the Peclet number
 - `pressureTools`: calculate static, total, etc pressure
 - `processorField`: writes the local processor ID
 - `Q`: write second invariant of the velocity gradient
 - `readFields`: read fields from the time directories and add to the registry
 - `turbulenceFields`: store turbulence fields
 - `vorticity`: write vorticity
 - `writeRegisteredObject`: writes fields that are not scheduled to be written
- **Write wall data**
 - `nearWallFields`: write data in cells adjacent to patches
 - `wallShearStress`: write the shear stress at wall patches
 - `yPlusLES`: write `y+` for LES models
 - `yPlusRAS`: write `y+` for RAS models
- **Flow visualization**
 - `streamlines`: streamlines from sampled fields
 - `surfaces`: iso-surfaces, cutting planes, patch surfaces, with field data
 - `wallBoundedStreamline`: streamlines constrained to a boundary patch
- **Miscellaneous**
 - `abortCalculation`: abort simulation when named file appears in the case directory
 - `cloudInfo`: write Lagrangian cloud information
 - `removeRegisteredObject`: remove specified registry objects in the database
 - `scalarTransport`: solve a passive scalar transport equation
 - `setTimeStepFunctionObject`: enable manual over-ride of the time step
 - `systemCall`: make system calls
 - `timeActivatedFileUpdate`: modify case settings at specified times