SDF Output with IOSDF

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Abstract

Thorn IOSDF provides I/O methods for 1D, 2D, and 3D output of grid arrays and grid functions into files in SDF format. The precise format is designed for visualisation using the clients xvs and DV (see http://www.cactuscode.org/VizTools/DataVaultXVSutils.html for details).

1 Purpose

Thorn IOSDF registers three I/O methods named IOSDF_1D, IOSDF_2D, and IOSDF_3D with the I/O interface in the flesh.

- IOSDF_1D
  creates one-dimensional output of 1D, 2D and 3D grid functions and arrays by slicing through the edge (in the octant case) or center (in all origin centered cases) of the grid in the coordinate directions. In addition, output is provided along a diagonal of the grid, in this case the diagonal always starts at the first grid point (that is, in Fortran notation var(1,1,1)) and the line taken uses grid points increasing by 1 in each direction. [NOTE: The diagonal output is not available for staggered variables].
  Output for each direction can be selected individually via parameters.
  Data is written in SDF format and goes into files with the names:

  ```
  <variable_name>_<slice>_<center_i><center_j>.sdf
  ```

  and for diagonals:

  ```
  <variable_name>_3D_diagonal.sdf
  ```

  These files can be processed directly by xvs and DV.

- IOSDF_2D outputs two-dimensional slices of grid functions and arrays planes. Again, slicing is done through the edge (in the octant case) or center (in all origin centered cases).
  Data is written in SDF format and goes into files named

  ```
  <variable_name>_<plane>_<center>.sdf
  ```

  These files can be visualized by DV.

- IOSDF_3D outputs three-dimensional grid functions and arrays as a whole.
  Data is written in SDF format and goes into files named

  ```
  <variable_name>_3D.sdf
  ```

  These files can be visualized by DV.

2 IOSDF Parameters

General parameters to control all IOSDF's I/O methods are:

- IOSDF::out[123]D_every (steerable)
  How often to do periodic IOSDF output. If this parameter is set in the parameter file, it will override the setting of the shared IO::out_every parameter. The output frequency can also be set for individual variables using the out_every option in an option string appended to the IOSDF::out[123]D_vars parameter.

- IOSDF::out[123]D_vars (steerable)
  The list of variables to output using an IOSDF I/O method. The variables must be given by their fully qualified variable or group name. The special keyword *all* requests IOSDF output for all variables. Multiple names must be separated by whitespaces.
  An option string can be appended in curly braces to the group/variable name. The only option supported so far is out_every which sets the output frequency for an individual variable (overriding IOSDF::out[123]D_every and IO::out_every).

- IOSDF::out[123]D_dir
  The directory in which to place the IOSDF output files. If the directory doesn't exist at startup it will be created.
  If this parameter is set to an empty string IOSDF output will go to the standard output directory as specified in IO::out_dir.

Additional parameters to control the IOSDF_1D I/O method are:

- IOSDF::out1D_[xyzd] (steerable)
  Chooses the directions to output in 1D IOSDF format (d stands for diagonal direction).

- IOSDF::out1D_[xyz]line_[xyz], IOSDF::out1D_[xyz]line_[xyz]i
  Chooses the slice centers for 1D lines from IOSDF_1D. These can be set either in physical or index coordinates. If they are set these parameters will override the default slice center parameters IO::out_[xyz]line[xyz], IO::out_[xyz]line[xyz]i.
  Note that the slice center can only be set for grid functions so far. For CCTK_ARRAY variables the slices will always start in the origin, ie. (0, 0, 0) in C ordering.

Additional parameters to control the IOSDF_2D I/O method are:

- IOSDF::out2D_[xyxzyz]plane_[xyz], IOSDF::out2D_[xyxzyz]plane_[xyz]i
  Chooses the slice centers for 2D planes from IOSDF_2D. These can be set either in physical or index coordinates. If they are set these parameters will override the default slice center parameters IO::out_[xyxzyz]plane[xyz], IO::out_[xyxzyz]plane[xyz]i.

Additional IOUtil parameters to control the IOSDF_[123]D I/O methods are:

- IO::out_downsample_[xyz]
  Chooses downsampling factors for individual dimensions (default is 1 meaning no downsampling).

3 Comments

Getting Output from IOSDF's I/O Mehtods
You obtain output by an I/O method by either

- setting the appropriate I/O parameters

- calling one the routines of the I/O function interface provided by the flesh

For a description of basic I/O parameters and the I/O function interface to invoke I/O methods by application thorns please see the documentation of thorn IOUtil and the flesh.

Building Cactus configurations with `IOSDF`

Thorn `IOSDF` requires the capability `SDF` which is provided eg. by thorn `CactusExternal/SDF`. You will need to include this thorn in your ThornList.

Since `IOSDF` uses parameters from `IOUtil` it also needs this I/O helper thorn be compiled into Cactus and activated at runtime in the `ActiveThorns` parameter in your parameter file.

References

[1] `http://www.cactuscode.org/VizTools/DataVaultXVSutils.html`

[2] `http://laplace.physics.ubc.ca/~matt/410/Doc/xvs/`

[3] `http://laplace.physics.ubc.ca/Doc/DV/`