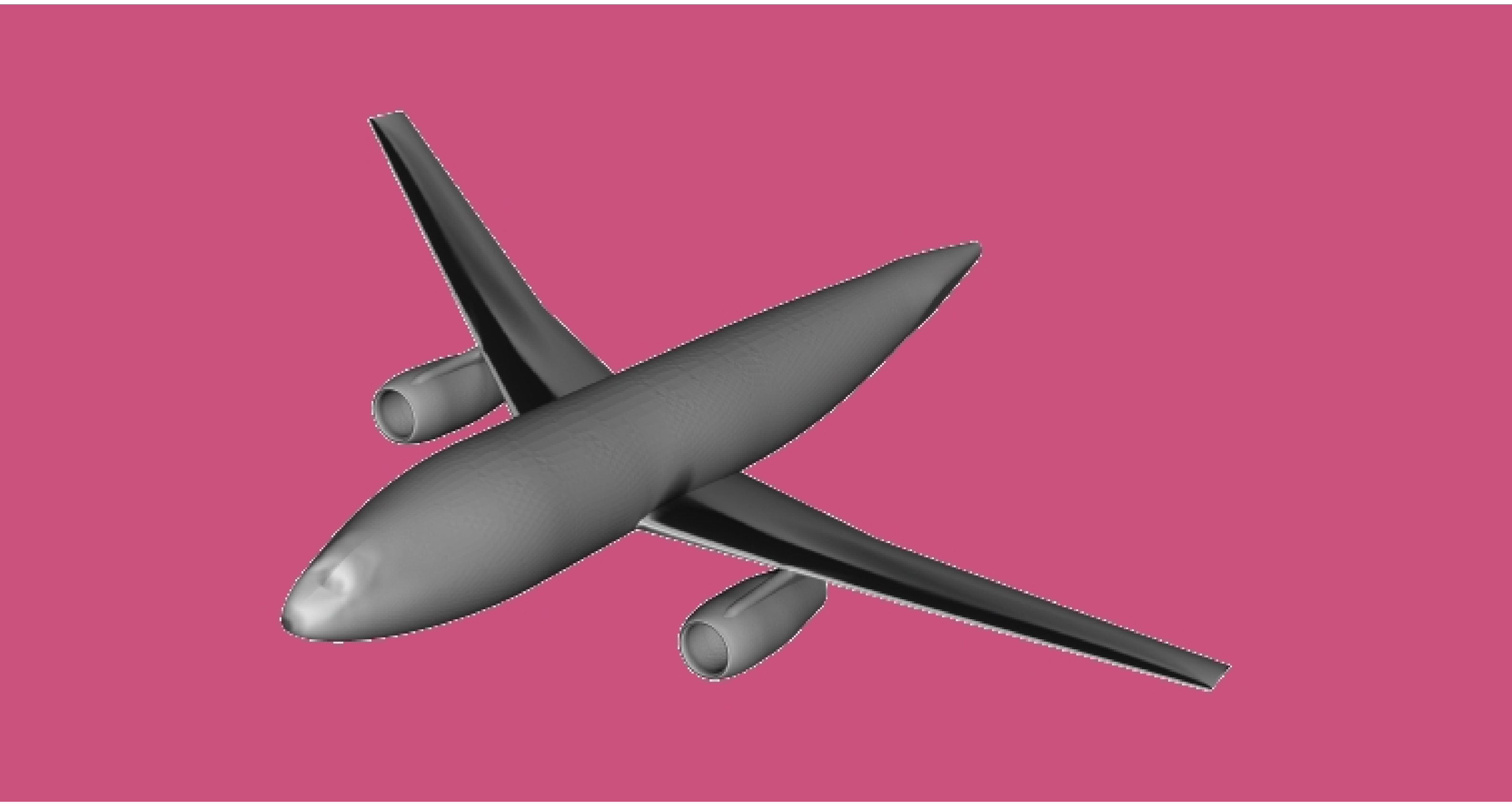
Edge
Quickstart



Edge

Defence and Security, Systems and Technology
FOI dnr 03-2870

March 2007
Issue 4.1.0

Edge
Quickstart

Contents

1 Introduction

2 CAD interfaces

2.1 Task

Spider converts IGES files to mesh surfaces which serve as input to the unstructured grid generator TRITET. Spider is interactive or automatic depending on the IGES file. A log file is created for repeating an interactive job.

2.2 Command

```
> spider -f_ [ -bhip ] igesfilename

    MANDATORY FLAGS

      -f : Determines resolution of surfaces.
           _ = real number, determines the mesh spacing.
           mesh spacing will be less than:
           _*50*(tolerance in the iges file)

    OPTIONAL FLAGS

      -i : Information from the iges file. No conversion.

      -b : Run in batch mode by use of logfile, the logfile is igesfilename.inp

      If logfile entries end before the run is completed, interactive
      mode will be entered.

      Retrimming and flipping of surfaces is not possible by batch commands
      it will be in the future

      -p : Get mesh on true CAD surface (only on type 128) as opposed to the
           default which is to project to a dense meshing of the CAD surfaces.
           The advantage is that points will be on true surface,
           the drawback is that mesh lines may wobble a little if cad surfaces are
           very badly parameterized or if resolution was set too low.

      -h : To get a more detailed instruction of how to use the program.
```

2.3 Work Plan

1. `> spider -i iges file`
   This is to inspect what's in the iges file before running spider. If there are other surface types than nurbs(128), see if the sending CAD can export surfaces as nurbs only. Other surface types (114,118,120,122) are supported but the quality of the meshes will not be as good in this release.

2. `> spider -f# -p iges file`
   This starts the conversion. # is a real number, try with 1000 the first time.

Spider tries to convert all surfaces without user interaction. If there are surfaces without natural corners or with more than one boundary loop, human interaction will be required for this surface.

After all surfaces have been converted they will be displayed in a FFANET window. If you are not satisfied with a surface there is an option to retrim a selection of surfaces.

The last stage in spider is to orient all surface normals in the same direction. You press the zbuffer button in the FFANET window to see the orientation.

Output from spider will be files GEO_TRITET_*, one for each surface. These files are in the ascii input format for the grid generators TRITET and FFANET. A logfile IGES_LOG to view the surfaces in FFANET is provided.

A log of the user input (__.inp) is provided to facilitate repeating or restarting an unfinished run.

2.4 Documentation

Online.

3 Grid Generation

3.1 Task

To generate a hybrid grid from geometry files (and an old grid file + solution file). Both tetrahedral and prismatic elements can be generated.

3.2 Command

```
> tritet
```

3.3 Work Plan

1. The geometry is defined by a set of surface patches. Each patch is represented by a quadrilateral M*N network of points. Each surface patch is stored on a separate file GEO_TRITET_1, GEO_TRITET_2, GEO_TRITET_3,... in FFANET ASCII-format. The networks should be of such a quality that it is possible to fit a bicubic spline surface.

2. The input parameters are given in the file PAR_TRITET. This file can be created/modified by Edit input parameters. Choose Set DEFAULTS for all parameters, then Edit Directory/Geometry parameters and Edit Background Grid parameters.

3. Convert the Boundary files to internal TRITET format and set boundary names for each surface patch by Convert Geometry files and specify boundary names. Do also specify surfaces for prismatic grid, if appropriate.

4. Specify the cell size for every surface patch by Set initial Background cell sizes. The cell sizes are visualized in the graphics viewer.

5. Compile the Background cell sizes into a Background grid by Compile and generate initial Background grid. This is done by a Delauny algorithm.

6. Compute the estimated number of triangles/tetrahedra to be generated by Compute estimated number of elements to be generated. Change the parameter Grid spacing multiplication factor by Edit input parameters/Edit Background Grid parameters to

get the proper number of cells. Note that the estimation may be very poor for the initial background grid.

7. Generate the Boundary grid by Generate Topology and Boundary/Surface grid. The edges of each surface patch are subdivided into one-dimensional straight elements. Spacing is interpolated from the background grid. The surface triangulation is generated by the Advancing Front algorithm in a parametric space of each surface patch. Spacing and stretching are interpolated from the background grid. The topology and surface grid can be visualized by Plot the grid.
8. Generate the Prismatic grid and modify the Boundary grid to match the prismatic grid by Generate Prismatic grid. The prismatic grid is generated by an advancing layer algorithm.
9. Generate the Interior grid with the advancing front method by Generate Interior grid.
10. Use the flow calculation to compute a new background grid by Adaptive generation of new Background grid. First set proper values on the parameters by Edit input parameters/Edit Grid Adaptation parameters. The new background grid can be used for generation of a new grid by Generate Topology and Boundary/Surface grid.

3.4 Documentation

Online.

Description of the methods can be found in Tysell (1994) and Tysell (1998).

4 Preprocessor

4.1 Task

To prepare grid data for the flow solver Edge. In the first step, cell-based information on the reference grid file (**.bmsh**) is converted to edge-based information on the flow solver grid file (**.bedg**). If the parameter NLEVEL in the input file is greater than 1 then a second step is performed where a multi-level grid is generated.

4.2 Command

```
> preprocessor p1 p2 p3
```

p3 – Preprocessed file (.bedg)
p2 – Input file (.ainp)
p1 – Mesh file (.bmsh)

4.3 Work Plan

1. If multigrid is to be used modify the parameters NLEVEL in the input file (ainp-extension). The variable NLEVEL determines the number of coarse grids created by the preprocessor. By default five levels are created. Note that NGRID≤NLEVEL otherwise you get an error. It might happen that you get less levels than you specified due the coarsest grid being too coarse. You should then decrease NGRID.

2. Run the program.

4.4 Documentation

Description of method is found in Berglind (2000).

5 Flow Solver

5.1 Task

To set up the input and to start a computation using Edge. To do so the **preprocessor** must have been applied as well as the program for setting the boundary conditions.

5.2 Command

Recommended is to start the flow solver from the user interface

```
> xedge
```

Provided all input has been set up the solver can also be started without the user interface

```
> edge_run case.ainp
```

where the input file **case.ainp** contains all relevant input data.

5.3 Work Plan

The input file has to be created by selection of desired input parameters described under Interface. If a more detailed description of all the available input parameters is wanted the default input file can be found at **$EDGE_HOME/lib/default_edge.ainp**

The user interface initializes a new computation with the variable in the default file, new settings overwrite the default settings and the input files is stored locally with a name chosen in the interface. It is also possible to directly copy the default input file to your local area and change it according to your desired settings.

Regardless if the input file is created from the user interface or by editing it is recommended to follow the following main steps in setting up the input

1. Check that the input file names are correct (edge file, bc file ...)
2. Choose your free stream values

3. Set the type of computation (Euler or viscous, INSEUL)
4. For viscous computations chose laminar or turbulent (ITURB) and set the desired level of viscosity (RMU)
5. For turbulent calculation set turbulence level (TUFREE,VRFREE)
6. Select number of multigrid levels (NGRID >1 for multigrid)
7. Select number of iterations (ITMAX)

There are many more parameters that may be set or tuned but these are usually the most crucial ones. In many cases the default values give a good choice.

5.4 Documentation

Description of solver Sjögren & Eliasson (1998).

6 Postprocessing

6.1 Task

6.2 Command

6.3 Work Plan

6.4 Documentation

7 Flow Visualization

7.1 Task

7.2 Command

7.3 Work Plan

7.4 Documentation

8 Example

8.1 Task

8.2 Command

8.3 Work Plan

8.4 Documentation

References

BERGLIND, T. 2000 An Agglomeration Algorithm for Navier–Stokes Grids. *AIAA Paper* **2000–2254**.

SJÖGREN, T. & ELIASSON, P. 1998 Description and Validation of EDGE. *Tech. Rep.* FFA TN 1998-61. FFA, the Aeronautical Research Institute of Sweden, P. O. Box 11021, S-161 11 Bromma, Sweden.

TYSELL, L. G. 1994 An Advancing Front Grid Generation System for 3D Unstructured Grids. In *Proceedings to ICAS-94*, pp. 1552–1564.

TYSELL, L. G. 1998 Adaptive Grid Generation for 3D Unstructured Grids. In *Proceedings to Numerical Grid Generation in Computational Field Simulations. International Society of Grid Generation (ISGG), Greenwich, England.*, pp. 391–400,.

FOI is an assignment-based authority under the Ministry of Defence. The core activities are research, method and technology development, as well as studies for the use of defence and security. The organization employs around 1350 people of whom around 950 are researchers. This makes FOI the largest research institute in Sweden. FOI provides its customers with leading expertise in a large number of fields such as security-policy studies and analyses in defence and security, assessment of different types of threats, systems for control and management of crises, protection against and management of hazardous substances, IT-security an the potential of new sensors.

FOI
Swedish Defence Research Agency
SE-164 90 STOCKHOLM
Tel: + 46 8 555 03000
Fax: + 46 8 555 03100
www.foi.se