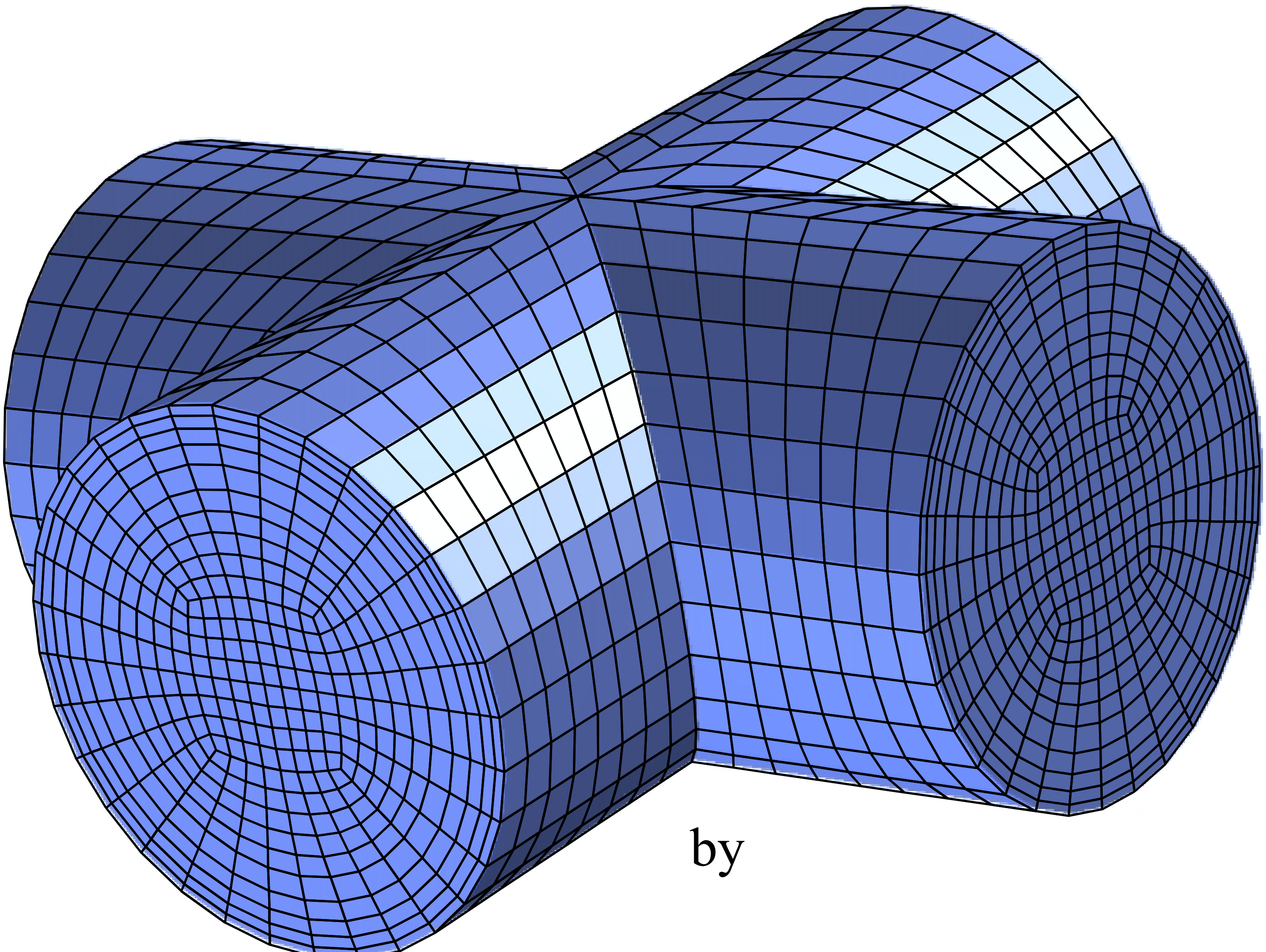
True*Grid*® Output Manual For STARCD®

A Guide and a Reference



by

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I. STARCD® Output Guide

STARCD® is a three-dimensional simulation code by CD-adapco to model fluid dynamics. The focus in this manual will be on those features in **True*Grid*®** that are specific to creating STARCD® input data. The **True*Grid*®** User's Manual covers the creation of a mesh and will not be covered in this manual. This manual is incomplete in another sense because it cannot be used as a substitute for a working knowledge of STARCD®.

Font Conventions

Different fonts are used through out this manual to indicate their meaning. A literal is highlighted in bold. A symbol to be substituted with a literal or a number is *italicized*. A computer example uses the `Courier font`. A button in from the Graphical User Interface is both ***italic and bold***.

Cell Shapes

The typical cell shape is a hexahedron brick. To form a wedge, pyramid, tetrahedron, or other degenerate brick cell, gather some of the nodes to collapse edges and faces. Then be sure to issue a merge command in the merge phase, such as the **stp** command, so that coincident nodes are merged into one node. See the STARCD Manual for the allowable degenerate bricks. There is no facility to cut corners off of a brick cell.

STARCD® Commands

The following is a list of **True*Grid*®** commands that can be used to produce features that are unique to STARCD® input data.

STARCD® feature	**True*Grid*®** commands
choose STARCD® format	**starcd**
associate an element type with a material	**starmats**
assign boundary conditions	**starbc**, **starbci**

Use the standard parts commands (**block** or **cylinder**) to generate a brick mesh. The element type is set by defining a material with the **starmats** command. Then elements are assigned a material number using the **mate**, **mt**, **mti** and **mtv** commands. Use the **starbc** and **starbci** commands in the part phase to specify boundary conditions. Alternatively, you can use the **starbc** command with face sets to define boundary conditions in the merge phase.

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STARCD® Input Files

The **starcd** command identifies the STARCD® file format for the output of nodes, bricks, and boundary conditions for STARCD®, version 3. The **starcd** command must be issued anytime before the **write** command in the merge phase. When the **write** command is issued, three files will be written. The default family name for these files is trugrdo. The family name can be specified on the **True*Grid*®** execute line or specified with the **mof** command. Each file is named using a suffix which is added to the family name. The file with the suffix (or file type) **.vrt** will contain the nodal or vertex data. The file with the suffix **.cel** will have the element or cell data. The file with the suffix **.bnd** will have the boundary conditions data. Be sure to issue a nodal merge command, such as **stp**, before issuing the **write** command.

The STARCD® input file with the suffix .inp is not produced by **True*Grid*®**. This file is a collection of prostar commands that gets everything else read. You should create this file and the use

```
IFILE,casename.inp
```

to begin importing. This file is strictly ascii and free format with as many lines as you need. Anything starting with '!' is a comment. There are additional fields in all these commands that you can enter but it would be best to look at the STARCD® manual to decide how much of them you need. This is the minimum.

```
TITLE
Put the title here
!Define the cell tables and cell table names
!Solids are ignored if conjugate heat transfer is off.
CTABLE,1,OPTION
CTNAME,1,NAME_FOR_CELL_TYPE_1
CTABLE,2,OPTION
CTNAME,2,NAME_FOR_CELL_TYPE_2
..
CTABLE,N,OPTION
CTNAME,N,NAME_FOR_CELL_TYPE_3 (no spaces)
!Read in cells and vertices
CREAD,casename.cel
VREAD,casename.vrt
!Define boundary region names and read boundaries
RNAME,1,name_of_region_1
RNAME,2,name_of_region_2
BREAD,casename.bnd
```

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II. STARCD® EXAMPLES

The following example creates a complete model for STARCD® and produces the three files named fourpipes.vrt, fourpipes.cel, and fourpipes.bnd. This problem is formed by intersecting four pipes. Three of the pipes are inlets and the fourth is an outlet.

```
title Four Intersecting pipes
c Choose the output format
starcd
c Choose the element type for material number 1
starmats 1 fluid ;
c  Create the geometry
sd 1 cy 0 0 0 0 0 1 1
sd 2 cy 0 0 0 0 1 0 1
sd 3 plan 0 0 0 0 1 0
sd 4 plan 0 0 0 0 1 1
sd 5 plan 0 0 0 0 1 -1
sd 6 cy 0 0 0 0 0 1 .7
c Use Transfinite Interpolation
intyp 2
c Create a part
block 1 11 19 29;1 11 19 29;1 9;-.3 -.3 .3 .3 -.3 -.3 .3 .3 1 2
c Delete the butterfly corner blocks
dei 1 2 0 3 4; 1 2 0 3 4;;
c Project to the outer cylinder
sfi -1 -4; -1 -4;;sd 1
c Insert a mid partition
insprt 1 4 2 4
c Position the vertices
pb 1 4 1 1 4 1 xyz -6.846159e-01 7.065985e-01 7.097514e-01
pb 2 5 1 2 5 1 xyz -6.846159e-01 7.065985e-01 7.097514e-01
pb 3 5 1 3 5 1 xyz 6.846159e-01 7.065985e-01 7.097514e-01
pb 4 4 1 4 4 1 xyz 6.846159e-01 7.065985e-01 7.097514e-01
pb 4 2 1 4 2 1 xyz 6.846159e-01 -7.065985e-01 7.097514e-01
pb 3 1 1 3 1 1 xyz 6.846159e-01 -7.065985e-01 7.097514e-01
pb 2 1 1 2 1 1 xyz -6.846159e-01 -7.065985e-01 7.097514e-01
pb 1 2 1 1 2 1 xyz -6.846159e-01 -7.065985e-01 7.097514e-01
c Glue the butterfly faces together
bb 3 2 1 4 2 2 1;bb 3 1 1 3 2 2 1;
bb 2 1 1 2 2 2 2;bb 1 2 1 2 2 2 2;
bb 1 4 1 2 4 2 3;bb 2 4 1 2 5 2 3;
bb 3 4 1 3 5 2 4;bb 3 4 1 4 4 2 4;
c Project to various planes for precision
sfi ; -3;;sd 3
sfi -1 0 -4;; -1;sd 2
```

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```
sfi 2 3; -1 0 -5; -1;sd 2
sfi ; 1 3; -1;sd 4
sfi ; 3 5; -1;sd 5
c Insert partitions for the boundary layer
insprt 1 1 4 5
insprt 1 2 1 5
insprt 1 3 5 5
insprt 1 4 1 5
c Position additional vertices
pb 4 3 2 4 3 2 xyz 2.999967e-01 -2.999968e-01 2.000000e+00
pb 4 5 2 4 5 2 xyz 3.000000e-01 3.000000e-01 2.000000e+00
pb 3 5 2 3 5 2 xyz -3.000000e-01 3.000000e-01 2.000000e+00
pb 3 3 2 3 3 2 xyz -2.999967e-01 -2.999968e-01 2.000000e+00
pb 4 5 1 4 5 1 xyz 3.000000e-01 3.000000e-01 3.000000e-01
pb 3 5 1 3 5 1 xyz -3.000000e-01 3.000000e-01 3.000000e-01
pb 4 3 1 4 3 1 xyz 3.000000e-01 -3.000000e-01 3.000000e-01
pb 3 3 1 3 3 1 xyz -3.000000e-01 -3.000000e-01 3.000000e-01
c Project to the boundary layer cylinder
sfi -2 -5; -2 -6;;sd 6
c Cluster the nodes toward the boundary
res 3 1 1 4 2 2 j 1.25
res 3 6 1 4 7 2 j [1/1.25]
res 5 3 1 6 5 2 i [1/1.25]
res 1 3 1 2 5 2 i 1.25
res 2 4 1 5 4 2 i 1
c Smooth the interior
unifm 2 3 2 5 4 2 & 3 2 2 4 3 2 25 0.0 1.0 ;
unifm 2 4 2 5 5 2 & 3 5 2 4 6 2 25 0 1 ;
unifm 2 3 1 5 4 1 & 3 2 1 4 3 1 25 0 1 ;
unifm 2 4 1 5 5 1 & 3 5 1 4 6 1 25 0 1 ;
c Assign material 1 to this mesh
mate 1
c Replicate the part
lct 3 rx 90;rx 180;rx 270;
lrep 0 1 2 3 ;
endpart
c Enter the merge phase
merge
c Merge identical nodes
stp .001
c Create surfaces to select face sets
sd 7 plan 0 0 -2 0 0 1
sd 8 plan 0 -2 0 0 1 0
sd 9 plan 0 0 2 0 0 1
sd 10 plan 0 2 0 0 1 0
c Create the face sets
fset face1 = surface  7 .01 4
```

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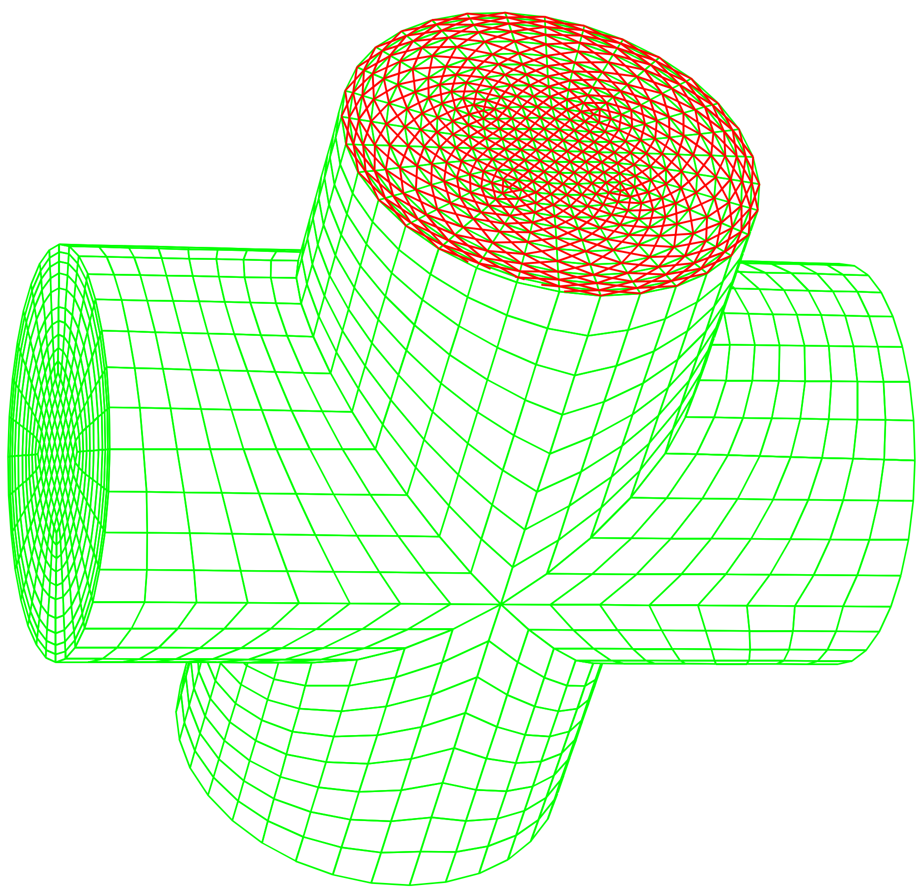
```
fset face2 = surface  8 .01 4
fset face3 = surface  9 .01 4
fset face4 = surface 10 .01 4
c Assign boundary conditions
starbc fset face1 1 0 inlet
starbc fset face2 2 0 inlet
starbc fset face3 3 0 inlet
starbc fset face4 4 0 outlet
c Create the input files for STARCD
mof fourpipes
write
```



Co starbc 4 was used to display the faces forming the outlet

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III. STARCD® OUTPUT REFERENCE

The syntax for commands are described below were literals are highlighted in bold. Symbols to be substituted are italicized. Each command is described by an entry like the following:

Command Syntax Conventions

When an arbitrarily long list of arguments are required, a semi-colon terminates the list. When a semi-colon is found in the description of an option or command, this indicates such a list. It is common to have a list inside another list. Each list must have a terminating semi-colon. This is analogous to parenthesis in algebraic expressions where the opening parenthesis must be balanced with a closing parenthesis. In this case, the keyword that initiates a list of items must be balanced with a closing semi-colon. Sometimes a short list of arguments and options can be repeated indefinitely, forming a list. The set of arguments and options that can be repeated are placed in square brackets. Sometimes the abbreviation #_*things* is used to mean "number of things". Each command is described by an entry like the following:

command summary description

command *arguments* brief description of functionality
with brief descriptions of what the *arguments* should be.
indentation is used to indicate a list of options to the *arguments*

Some commands in the part phase require a region specification. The region selects a face of the mesh, among other things. Others may require a progression specification. The progression selects multiple faces, among other things. In the merge phase, such commands require an option. In all of these cases, a portion of the mesh is identified.

Remarks

When present, the Remarks section describes the command in even greater detail. It may describe the context in which the command is normally used, and other commands used in association with this command. It may describe side effects. It may describe other, similar commands. In many cases, it includes a description of where to find the command in the menus.

Examples

When present, this shows the exact use of the command. If you use the dialogues, this command will be generated by simple selection options with the mouse and entering data where indicated. The command, as shown here, will appear in the session file for later reuse and possible modification.

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You can also enter the command into the text window or insert it into a command file to be run in batch mode.

starmats STARCD® element type selection

starmats *material_# type* ;

where *type* can be

fluid
solid
baffle

Remarks

The element type is set by defining a material with the **starmats** command. Then elements are assigned a material number using the **mate**, **mt**, **mti** and **mtv** commands.

starbc STARCD® boundary conditions, regions - part phase

starbc *i1 j1 k1 i2 j2 k2 region_id radiation_id type*

where *type* can be

inlet
outlet
symplane
wall
cyclic
stagnation
pressure
baffle
freestream
transient
attach
radiation
degas
riemann
internal
npressure
nrstagnation

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Remarks

The *region_id* and the *radiation_id* are required by STARCD®. Only the *region_id* is used in **True*Grid*®** to choose the boundary condition to be displayed (see the **co** command). The *radiation_id* plays no role in **True*Grid*®** and is simply passed onto the *.bnd boundary output file.

starbci STARCD® boundary conditions, progressions - part phase

starbci *i_list; j_list; k_list; region_id radiation_id type*
where *type* can be

inlet
outlet
symplane
wall
cyclic
stagnation
pressure
baffle
freestream
transient
attach
radiation
degas
riemann
internal
npressure
nrstagnation

Remarks

The *region_id* and the *radiation_id* are required by STARCD®. Only the *region_id* is used in **True*Grid*®** to choose the boundary condition to be displayed (see the **co** command). The *radiation_id* plays no role in **True*Grid*®** and is simply passed onto the *.bnd boundary output file.

starbc STARCD® boundary conditions of face sets - merge phase

starbc *fset_set_name region_id radiation_id type*
where the region *type* can be

inlet

outlet
symplane
wall
cyclic
stagnation
pressure
baffle
freestream
transient
attach
radiation
degas
riemann
internal
npressure
nrstagnation

Remarks

Each region ID is assumed to consist of a contiguous area of a boundary. If you do not specifically call out a boundary on an exterior face, it assumes that face belongs to the region identified with 0. You can set region 0 to any region *type* but most commonly its set to be a **wall**.

A face set is created and modified using the **fset** and **fseti** commands in the part phase and the **fset** command in the merge phase. A fset can also be created or modified using the ***Sets*** button in the ***Pick*** panel of the Environment Window while in the merge phase. A face set is named at the time it is created and any character string can be used to name it.

The *region_id* and the *radiation_id* are required by STARCD®. Only the *region_id* is used in **True*Grid*®** to choose the boundary condition to be displayed (see the **co** command). The *radiation_id* plays no role in **True*Grid*®** and is simply passed onto the *.bnd boundary output file.

condition specify type of condition/constraint to be displayed

condition starbc *region_id*
or
co starbc *region_id*

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