The Neutral Map File

This page is a copy from an original GEOLAB (NASA) webpage that has since gone offline. It provides documentation about the "neutral map file" (*.nmf) which provides boundary condition and connectivity information for multi-block structured grids. The original documentation was written by William T. Jones of NASA Langley. "V2K" refers to the original GEOLAB program that made use of the neutral map file; references to V2K on this page can be ignored.

The neutral map file provides a formatted summary of information relating to

- the size and composition of the mesh,
- topological features of the mesh and
- assigned flow field boundary conditions

which is typically required of any multi-block flow solver. The formatting of this file is "neutral" in that it is not specific to any particular flow solver, thus a reformatting of the data will be required before use.

To serve as an example, a neutral map file for a simply-connected four block mesh is listed below. The specifics of the configuration are not important here as the goal of this description is to give an idea of the typical content and organization of such a file.

The file consists of two sections; the first defines the size (in blocks) of the mesh as well as the size of each block within the mesh, and the second section defines the topological features of the mesh which may involve

- point continuous block interfaces,
- singularities and/or
- patched interfaces.

Also included in the summary are any flow field boundary conditions which have been placed by the user.

```
# ===== Neutral Map File generated by the V2k software of NASA Langley's GEOLAB =====
# ================================================================================
# Block#   IDIM   JDIM   KDIM
# --------------------------------------------------------------------------------
       4

       1     47     26     33
       2     19     26     33
       3     19     24     33
       4     47     24     33

# ================================================================================
# Type          B1  F1     S1   E1     S2   E2     B2  F2     S1   E1     S2   E2  Swap
# --------------------------------------------------------------------------------
WALL            1   1      1   47      1   26
WALL            1   2      1   47      1   26
ONE_TO_ONE      1   3      1   26      1   33     2   4      1   26      1   33  FALSE
outflow         1   4      1   26      1   33
ONE_TO_ONE      1   5      1   33      1   47     4   6      1   33      1   47  FALSE
WALL            1   6      1   33      1   47
WALL            2   1      1   19      1   26
WALL            2   2      1   19      1   26
Inflow          2   3      1   26      1   33
ONE_TO_ONE      2   5      1   33      1   19     3   6      1   33      1   19  FALSE
WALL            2   6      1   33      1   19
WALL            3   1      1   19      1   24
WALL            3   2      1   19      1   24
Inflow          3   3      1   24      1   33
ONE_TO_ONE      3   4      1   24      1   33     4   3      1   24      1   33  FALSE
WALL            3   5      1   33      1   19
WALL            4   1      1   47      1   24
WALL            4   2      1   47      1   24
outflow         4   4      1   24      1   33
WALL            4   5      1   33      1   47
```

Associated with each topological entry and boundary condition is a description as to its location within the mesh. Each of the entries in the second section of this file are defined in detail within the table below.

Topological Feature Description

Entry	Definition
Type	The type of featured (topological or boundary condition) to be defined and positioned within the mesh. Valid entries for *Type* are summarized in the table below.
B1	The number of the first block associated with the *Type*.
F1	The face number for the specified block. Valid entries for *Face* are summarized in the table below.
S1	The starting index in the primary coordinate direction for the face.
E1	The ending index in the primary coordinate direction for the face.
S2	The starting index in the secondary coordinate direction for the face.
E2	The ending index in the secondary coordinate direction for the face.
B2	The second block number associated with the *Type*.
F2	The face number for the specified block.
Swap	Orientation flag (specified only for *Type = ONE_TO_ONE*. This flag is *FALSE* if the primary directions of the two identified faces are aligned (though perhaps in opposite directions) and *TRUE*otherwise.

The valid entries under the *Type* heading are as given in the table below.

Summary of Valid Interface Types

Type Name	Definition
Collapsed	Face collapsed to a single point (*V2K* will not detect this kind of interface automatically; it must be user defined via direct editing of the neutral map file).
ONE_TO_ONE	A point-to-point continuous interface between two blocks the valid index range for which is described as listed above. Such an interface may comprise any portion of the block face. This type also requires the specification of a secondary block, face and indices describing the complete connectivity. *V2K* provides facilities to detect this type of interface automatically.
Patched	A block interface for which point-to-point continuity does not exist though flux transport ocurrs across the identified face. *V2K* provides facilities to identify this type of interface which is described similarly to the ONE_TO_ONE interface type. The exception is that the full index range of both counterparts are listed and it is left to the flow solver to define the appropriate index range and interpolation parameters.
POLE_DIR1	Describes a singularity within a block for which the collapsed edge corresponds to the primary direction of the face.*V2K* provides facilities to detect this type of interface automatically.
POLE_DIR2	Describes a singularity within a block for which the collapsed edge corresponds to the secondary direction of the face.*V2K* provides facilities to detect this type of interface automatically.
Symmetry-X	A flow field boundary condition which is to provide for symmetry in the x-direction.
Symmetry-Y	A flow field boundary condition which is to provide for symmetry in the y-direction.
Symmetry-Z	A flow field boundary condition which is to provide for symmetry in the z-direction.
UNPROCESSED	A block boundary or portion thereof for which no *Type* assignment has been made. An initial neutral map file will be composed only of this type and a completed (and valid) neutral map file will have none of this type.
WALL	A solid wall boundary condition whose actual interpretation (slip or no-slip) will depend upon the type of flow solver to be employed.

Note that additional boundary conditions may be user defined.

Lastly, the face number specification identifies a particular face within a block whose position is dependent upon the local coordinate system employed within that block. This relationship is summarized in the table below.

Block Face Identification

Face Number	constant index	primary coordinate	secondary coordinate
1	k_{min}	i	j
2	k_{max}	i	j
3	i_{min}	j	k
4	i_{max}	j	k
5	j_{min}	k	i
6	j_{max}	k	i