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WINGBOX •

Usage V1

WINGBOX

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Input File Structure

The input file format of WINGBOX is rather rudimentary as it was done as a demonstrator protype. The input will be largely improved and rationalized in the next versions.

Line 1

- **Flag** for whether the tube is OPEN or CLOSED

```
FLAG 0=OPEN, 1=CLOSED
```

Comment: this input will be removed as it will be obsolete. The User should give 1 always from now on. An Open Section is currently treated as a "special case" of a Closed Section.

- **Number of Nodes** defining the basic cross section of the (multi)cell. (**NODETOT**)

- **Connectivity** of each cell in a multicell, with the node ID listing in a counterclockwise fashion (preferably starting from the top), sequencing each cell section from left to right and "closing" each cell loop by repeating the first node ID as last, too.
  - Example: assume a 4 node cell section with nodes ID in a counterclockwise fashion as 2 , 5 , 6 , 10. Then the connectivity list will be :
    - **2 5 6 10 2** (fist node repeated to "close" the cell loop)
    - and NODETOT will be **5**

- Separation between the cells in a Multi Cell case is by giving a node ID ZERO in the list.
  - Hence if a second cell was stuck next to the previous cell, and with a connectivity sequence 9 2 10 11 9, the following Connectivity card **for the Multi Cell** should be given:
    - **2 5 6 10 2 0 9 2 10 11 9**
    - and NODETOT will be **11**
    - also note that the two cells are linked (to make the Multi Cell) by the segment 10 2 that appears in both connectivities, in a counterclockwise fashion in each cell.

Line "2" (repeated as many times as nodes)

Coordinates for each node defining the section.

Two sets of X Y Z coordinates for the first and last section, in order to deal with taper, assumed along the z-axis.

- Example: **2.0 3.5 0.4 3.6 5.1 20.6** (the coordinates X=2.0 Y=3.5 are at the section at Z=0.4 while the coordinates X=3.6 Y=5.1 are at the section at Z=20.6)

Line 2 is repeated as many times as distinct nodes.

Line 3

Nodal thicknesses. This is for the case where the thickness varies linearly over a segment and is defined by its nodal value.

Input as many thickness values as distinct nodes, in the ascending sequence of the nodal numbering.

If the nodal thickness values are given as 0, then the code will need the thickness input from the next input Line-set.

Line "4" (repeated as many times as segments)

Segment **definition** by 2 distinct nodes and associated web or spar **thickness**

- Example: **6 10 0.833** means the segment with nodes 6 and 10 has a thickness of 0.833

Attention: If the nodes have been defined as nodal, then this input is not needed, and this can be achieved by giving only the line with 0 0 0 as input. Then the code will abandon reading thicknesses by segments.

Line 5

Boom cross sectional **areas**.

These are nodal quantities and must be defined for **each** node. For nodes that do not have booms associated with them, input a 0.

- Example: **645 1290 1935 1935 1290 645 0** are the booms implicitly for nodes 1 2 3 4 5 6 7. Note that node 7 has NO boom (a 0 is given)

Line 6

Six inputs are given that correspond to:

WX and WY, the distributed loads on the section,

SX and SY, the shear loads on the section.

MX and MY, the bending moments applied on the section.

Line 7

Input for the time being **0.0 0.0**

This input line is almost obsolete and will be replaced later on.

Line 8

Nodal Shear Modulii. This is for the case where the Shear Modulus varies linearly over a segment and is defined by its nodal value.

Input as many thickness values as distinct nodes, in the ascending sequence of the nodal numbering.

If the nodal modulii values are given as 0, then the code will need the modulii input from the next input Line-set.

Line "9" (repeated as many times as segments)

Segment **definition** by 2 distinct nodes and associated web or spar **Shear Modulus.**

- Example: **6 10 40.3E06** means the segment with nodes 6 and 10 has a Shear Modulus of 40.3E06.

Attention: If the nodes have been defined as nodal, then this input is not needed, and this can be achieved by giving only the line with 0 0 0 as input. Then the code will abandon reading modulii by segments.

Line 10

One input is given for the Section **Torque**.

Line 11

Two inputs are given: XDISTSY, YDISTSX

For the “X distance of SY force application” and the “Y distance of SX force application”.

Line 12 (repeated as many times as Cells in a Multi Cell case)

Four inputs are given in each line corresponding to the first segment of the cell, the last segment of the cell, the neighbouring segment to the left cell and the neighbouring segment to the right cell. This is for the calculation of the interface shear flows.

Example: assuming a multicell with three cells: cell 1 with three segments (1-2-3 “triangular”) , cell 2 with four segments (6-7-8-9) and cell 3 with four segments (12-13-14-15), the multi cell section definition from the three cells will be:

```
1 3 2 3
6 9 7 9
12 15 13 15
```

where segment 3 (right segment of cell 1) pairs with segment 7 (left segment of cell 2) and segment 9 (right segment of cell 2) pairs with segment 13 (left segment of cell 3).

Line 13

One input is given for the **skin participation in direct stress carrying**. Normally if booms are present, one can chose that the skin carries only shear flows, however this is not mandatory.

If given as ZERO, then the skin carries only shear flows, **otherwise must be given as 1.**

Line 14

Two inputs are given: the reference **Young’s Modulus** and the reference **Density.**

Line 15

Two inputs are given: the reference **length of the tube** and the **number of sections** that we want to have define along the length for stress and displacement output.