EXPORTING NODES TEMPERATURES IN THE PROGRAMS BISTRA & BISCO

Introduction

This document explains how to handle node temperatures from the solution file with extension .sol for the programs BISTRA & BISCO for external post-processing purposes. The solution files with extension .sol for the programs BISTRA & BISCO are text files listing the node temperatures. The information on how these temperatures are listed in the .sol file is stored in the triangulation file with extension .tri.
The transient program BISTRA reports a solution file for each time step, but the definition is the same as for the steady-state program BISCO (which has only 1 .sol file). Therefore the examples used in this document are BISCO project files.

Structure of triangulation file (.tri)

The triangulation file with extension .tri is a text file (which can be opened with text editor) with the following structure:

S: Size
1) Total pixels in bitmap in X-direction x 16
2) Total pixels in bitmap in Y-direction x 16
3) Resolution of the coordinates of the triangulation vertices: 16 (fixed value)

Note: the resolution of the coordinates of the triangulation vertices is 16 times finer than the pixel resolution of the bitmap.

D: Dimensions
1) Total number of object nodes
2) Total number of triangles in the triangulation
3) Total number of triangle edges at boundary conditions
4) Total number of view factor zones (for RADCON types)

P: Points
1) Node index
2) X-coordinate
3) Y-coordinate

T: Triangles
1) Colour index of triangle (bitmap colour index)
2) Node index of point 1
3) Node index of point 2
4) Node index of point 3

Note: negative node index indicates start of object line (triangle edge between different bitmap colours)

B: Boundary condition lines (= triangle edges at boundary condition)
1) Colour index of material (bitmap colour)
2) Colour index of boundary condition (bitmap colour)
3) Number of view factor zone (for RADCON types)
4) Node index of point 1

5) Node index of point 2

L: Lines at colour interfaces (only for BISCO)

Structure of solution file (.sol)

The solution file with extension .sol is a text file containing the calculation node temperatures and has the following structure:

D: Dimensions
1) Total number of object nodes
2) Total number of triangles in the triangulation
3) Total number of triangle edges at boundary conditions
4) Total number of view factor zones (for RADCON types)

R: Results
1) Total number of calculation nodes (including nodes for radiation and convection!)
2) Maximum temperature difference (between last two calculation iterations)
3) Heat flow divergence for total object
4) Heat flow divergence for worst node

N: Nodes temperatures

C: Temperatures in the convective nodes (per colour index of bitmap)

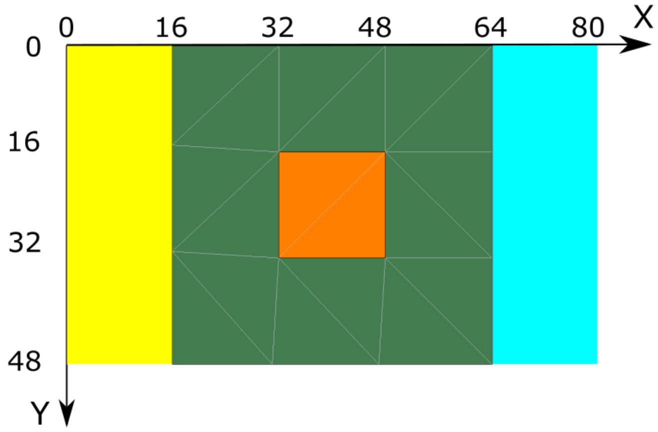
I: Minimum and maximum temperature (per colour index of bitmap)

Example 1 : non-RADCON types

Example1.bsc

This example contains a simple bitmap with 5 pixels in the X and 3 pixels in Y. Following colour definitions are used:
- Yellow (colour index 7): type BC_SIMPL
- Green and orange (colour index 27 and 28): type MATERIAL
- Cyan (colour index 5): type BC_SIMPL

The figure below shows the bitmap indicating the mesh and the coordinate system (XY). Herein the triangulation vertices are 16 times finer than the pixel resolution of the bitmap.



Example1.tri

S 80 48 16
D 20 18 6 0
P ...
T ...
B...
L ...

Figure 1 Bitmap with triangulation mesh and coordinate system

Following figures illustrate the definition of the 1) object nodes, 2) triangles and 3), triangle edges at boundary conditions for the example file:

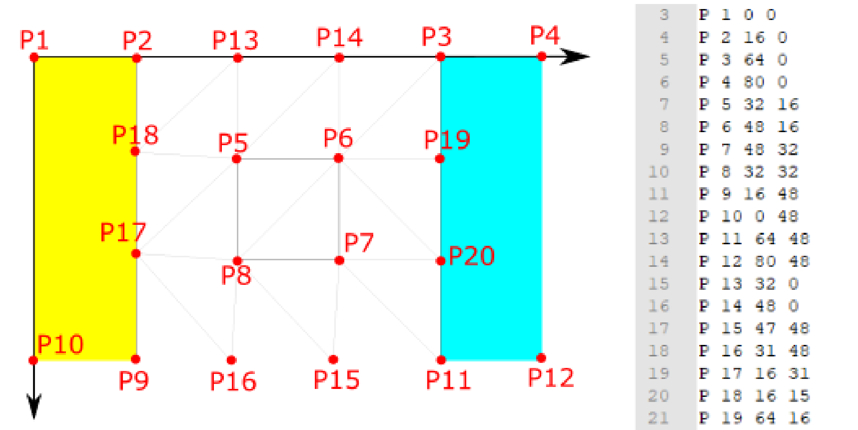


Figure 2 Object nodes

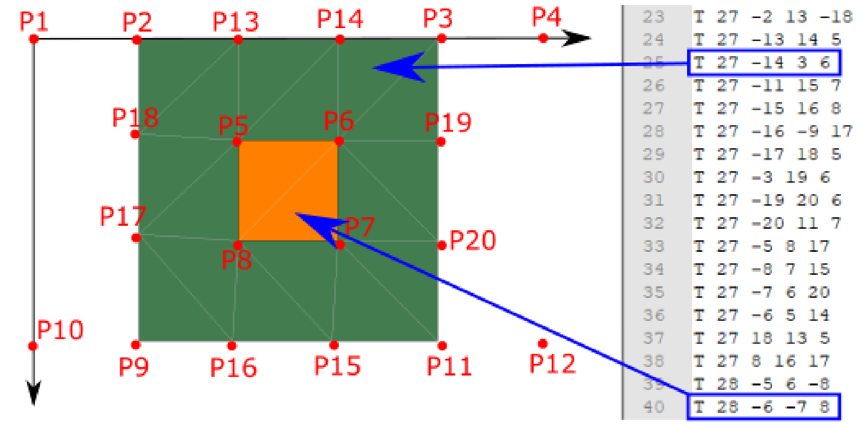


Figure 3 Examples of triangle definitions

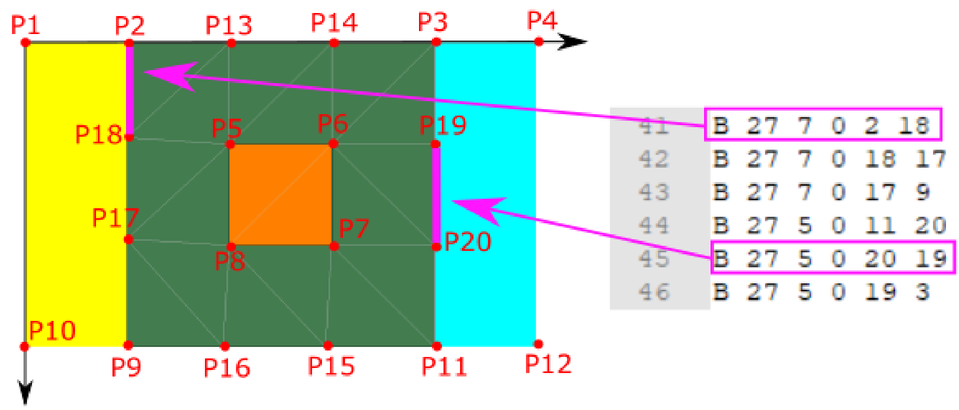


Figure 4 Examples of triangle edges at boundary condition definitions

The solution file with extension .sol lists the temperatures in the calculation nodes in the rows starting with N. First all the object nodes are listed (see Figure 2). If present the convective and radiation nodes are listed thereafter.
In the example here no RADCON types are used, so, the total number of object nodes equals the total number of calculation nodes.

node number	T(°C)	node number	T(°C)
P1	0	P11	14.47208398
P2	1.702598089	P12	0
P3	14.47208398	P13	5.959093384
P4	0	P14	10.21558868
P5	5.959093388	P15	9.949557726
P6	10.21558868	P16	5.693062433
P7	10.21558868	P17	1.702598092
P8	5.959093389	P18	1.702598096
P9	1.70259809	P19	14.47208398
P10	0	P20	14.47208398

Example 2: RADCON types

Example2.bsc

The same example file is used but the type MATERIAL for colour index 28 (orange) is changed now to TRANSMAT (equivalent thermal conductivity (convection) and radiosity method for IR radiation). D

This has the following consequences (for this example):

- object nodes remains the same: 20
- number of calculation nodes increases: 25
- view factor zone is now 1
- Total number of boundary condition lines increases: 10

In the solution file, the first 20 lines starting with N represent the object node temperatures, the following 5 rows are the temperatures (here in red) used for the calculation of IR radiation in the view factor zone (TRANSMAT).

node number	T(°C)	node number	T(°C)
P1	0	P11	14.3059539
P2	1.736441873	P12	0
P3	14.30433746	P13	6.053833327
P4	0	P14	9.974183508
P5	6.25685681	P15	9.722795338
P6	9.769281155	P16	5.793269498
P7	9.768458507	P17	1.786171371
P8	6.257549582	P18	1.782686648
P9	1.735486168	P19	14.23560034
P10	0	P20	14.235542
		A1	8.013064583
		A2	9.530433824
		A3	8.013008567
		A4	6.495639325
		A5	0

Example 3: RADCON types

Example3.bsc

Finally, the same example file is used again with a type BC_FREE for colour index 28 (orange). This has the following consequences (for this example):

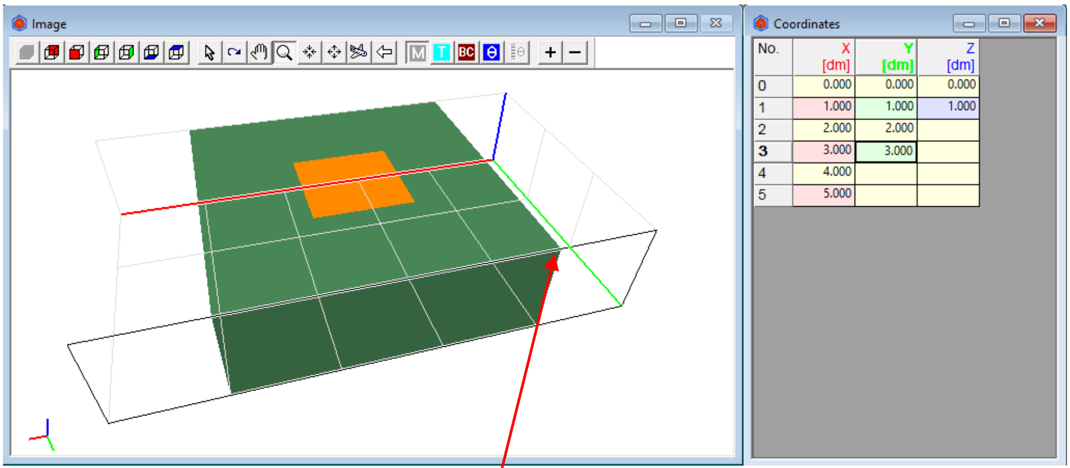
- object nodes remains the same: 20
- number of calculation nodes increases: 26 (an extra convection node now)
- view factor zone is now 1
- Total number of boundary condition lines increases: 10

In the solution file, the first 20 lines starting with N represent the object node temperatures, the following 6 rows are node temperatures used for the calculation of IR radiation and convection in the view factor zone (BC_FREE).

TRISCO and VOLTRA

Example1_TRISCO.trc

The solution file with extension .sol for TRISCO (and VOLTRA) is easier to interpret as the node temperature are mentioned with the corresponding coordinates:




```
N 1.7025980928 1 0 0
N 1.7025980929 1 0 1
N 1.7025980928 1 1 0
N 1.7025980929 1 1 1
N 1.7025980929 1 2 0
N 1.7025980914 1 2 1
N 1.7025980924 1 3 0
N 1.7025980900 1 3 1
N 5.9590933883 2 0 0
N 5.9590933884 2 0 1
```

Figure 5 Example of node temperatures in .sol file for TRISCO