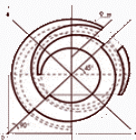


October 2002

ALSTOM

ThermXL v2 & Beyond

Julian Thomas



Spreadsheet Thermal Analysis

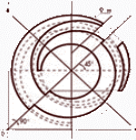
- Overview of ThermXL
- New features of v2 (released June 2002)
- Upcoming developments

The screenshot shows an Excel spreadsheet with the following data tables:

Number	Label	Type	mC	o	z	Area	GS	GA	GE	GI	T0 [C]	T1 [C]	RCtime
1	Panel	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	20.00	0.00
2	Unit	D	0.00	0.00	0.00	0.00	0.00	2.98	8.00	0.00	0.00	12.81	0.00
6	9999 Space	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-269.00	-269.00	0.00

Label	First Node	Second Node	Value	Heat Flow
Panel to Unit	1	2	0.16	1.151e+00

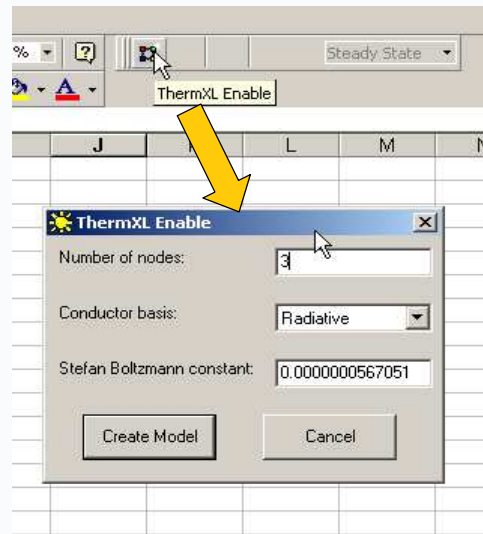
Label	First Node	Second Node	Value	Heat Flow	View Factor
Radiative link to space	2	9999	0.03	1.213e+01	



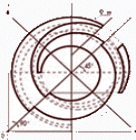
ThermXL Overview



Create a new ThermXL model with 3 nodes...



- SCREENSHOT FROM LIVE DEMO -



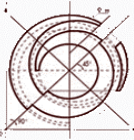
ThermXL Overview



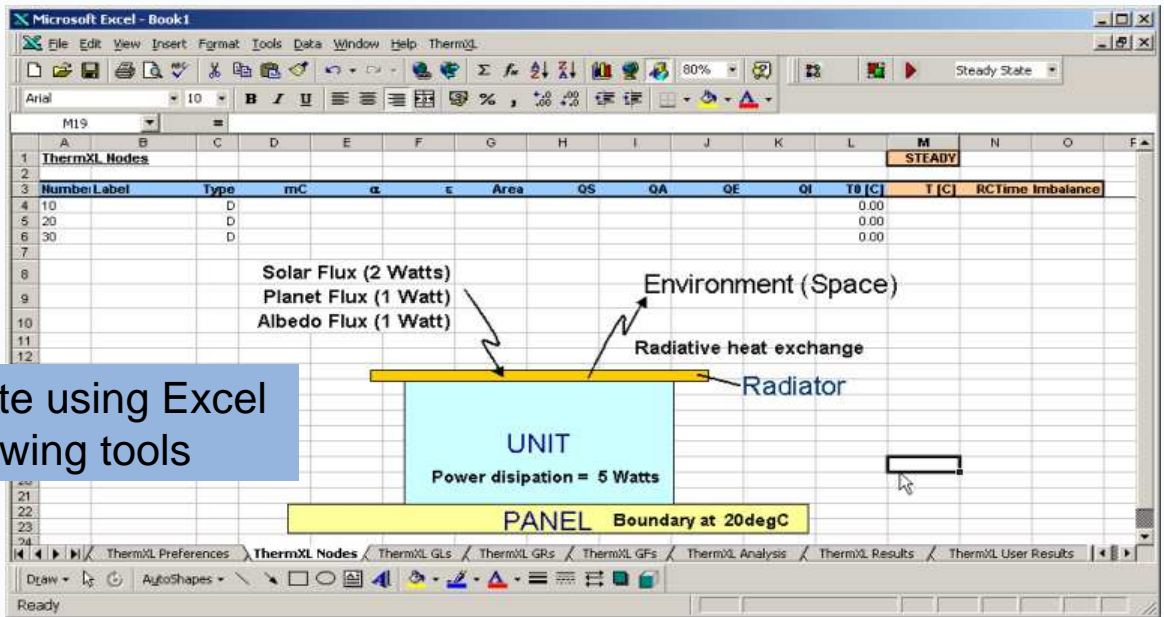
Number	Label	Type	mC	α	ϵ	Area	QS	QA	QE	QI	T0 [C]	T [C]	RC Time Imbalance
10		D	10								0.00	0.00	
20		D	20								0.00	0.00	
30		D	30								0.00	0.00	

ThermXL structure created (Node worksheet shown).

- SCREENSHOT FROM LIVE DEMO -



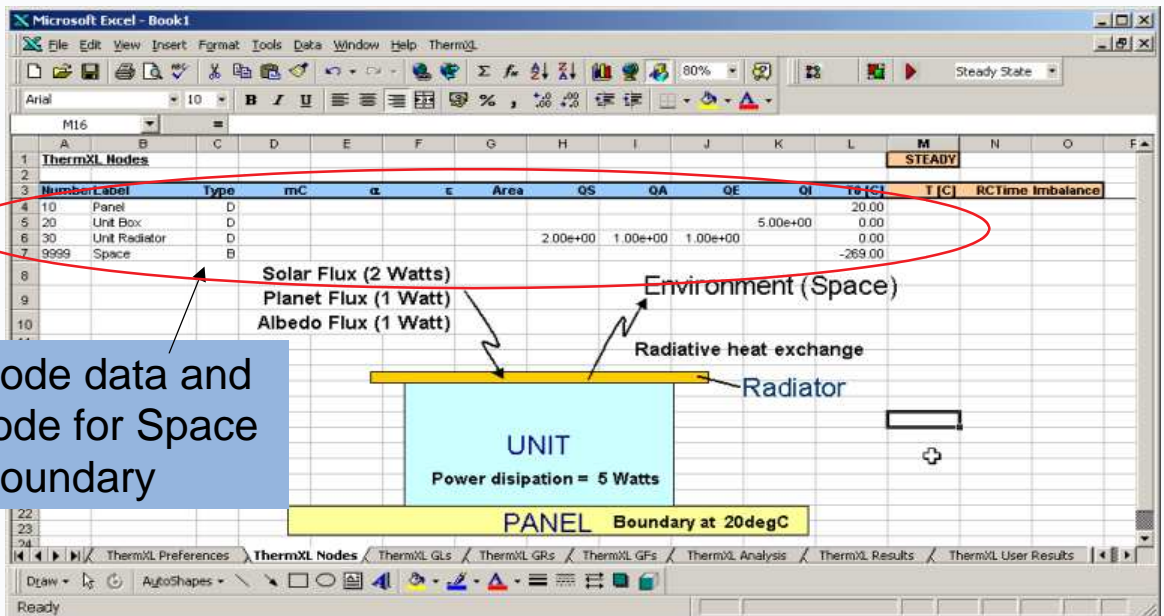
ThermXL Overview



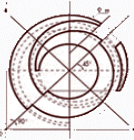
- SCREENSHOT FROM LIVE DEMO -



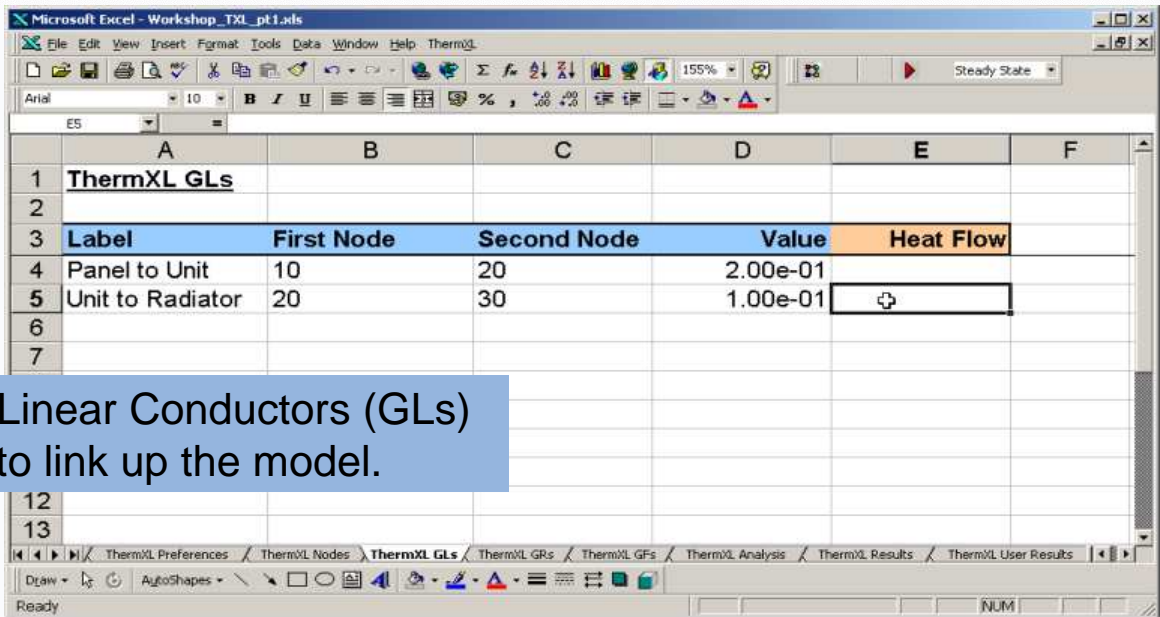
ThermXL Overview



- SCREENSHOT FROM LIVE DEMO -



ThermXL Overview



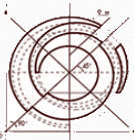
Microsoft Excel - Workshop_TXL_pt1.xls

Label	First Node	Second Node	Value	Heat Flow
Panel to Unit	10	20	2.00e-01	
Unit to Radiator	20	30	1.00e-01	

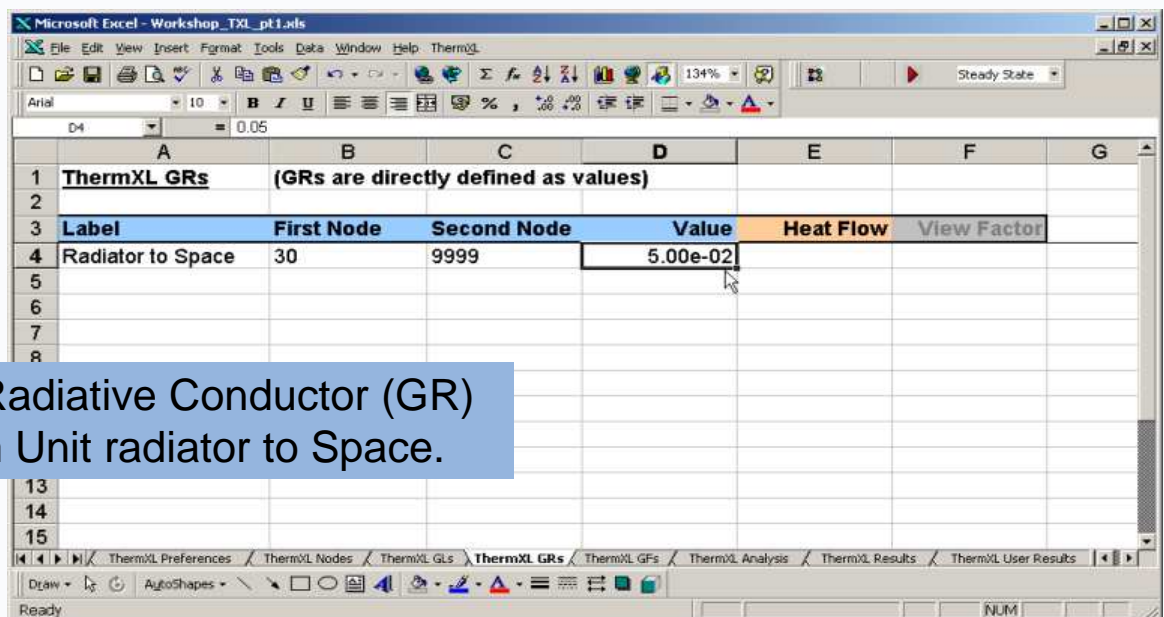
Ready

Add Linear Conductors (GLs) to link up the model.

- SCREENSHOT FROM LIVE DEMO -



ThermXL Overview



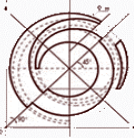
Microsoft Excel - Workshop_TXL_pt1.xls

Label	First Node	Second Node	Value	Heat Flow	View Factor
Radiator to Space	30	9999	5.00e-02		

Ready

Add Radiative Conductor (GR) from Unit radiator to Space.

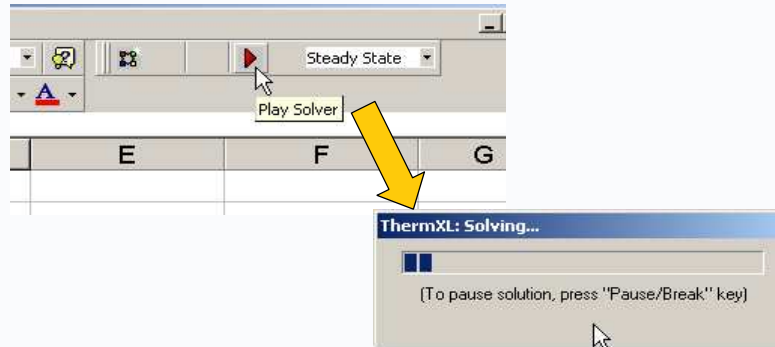
- SCREENSHOT FROM LIVE DEMO -



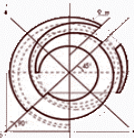
ThermXL Overview



Run the analysis...



- SCREENSHOT FROM LIVE DEMO -



ThermXL Overview

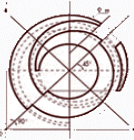


The screenshot shows the ThermXL software interface with the 'ThermXL Results' dialog box open. The dialog box displays a table of temperature results for different node numbers. The table has columns for 'Time', 'PANEL', 'UNIT BOX', 'UNIT RADIATOR', and 'Space'. The data is as follows:

Time	PANEL	UNIT BOX	UNIT RADIATOR	Space
SS	10	20	30	9999
	20.00	18.66	-34.03	-269.00

The dialog box also shows a 'View Temperature Results' button. The background shows a portion of an Excel spreadsheet with columns A, B, C, D, E, and F visible.

- SCREENSHOT FROM LIVE DEMO -



ThermXL Overview



Define some simple groups...

Select nodes...

Number	Label	Type
10	PANEL	B
20	UNIT BOX	D
30	UNIT RADIATOR	D
9999	Space	B

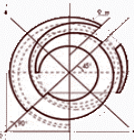
then ...



Create group named 'Unit'
then...

Add groups for 'Space'
and 'Panel'

- SCREENSHOT FROM LIVE DEMO -



ThermXL Overview



Number	Label	Type	mC	α	ϵ	Area	QS	QA	QE	QI	T0 [C]
20	UNIT BOX	D	0.00e+00	0.00	0.00	0.00e+00	0.00e+00	0.00e+00	0.00e+00	5.00e+00	0.00
30	UNIT RADIATOR	D	0.00e+00	0.00	0.00	0.00e+00	2.00e+00	1.00e+00	1.00e+00	0.00e+00	0.00

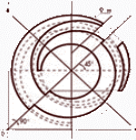
Label	Type	mC	α	ϵ	Area	QS	QA	QE	QI
Unit	D	0.00e+00	#DIV/0!	#DIV/0!	0.00e+00	2.00e+00	1.00e+00	1.00e+00	5.00e+00

Group Temperatures	Value
T Arith. Mean	-7.69
T mC Weighted	#DIV/0!
T Area Weighted	#DIV/0!
Min. T	-34.03
Max. T	18.66

Heat Flows	Panel	Space	Unit
SS	-0.269	9.26891456	-

View results for groups
(need to re-run solution).

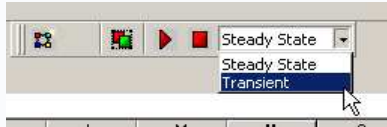
- SCREENSHOT FROM LIVE DEMO -



ThermXL Overview



Set-up for transient case...

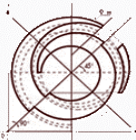


Define heat capacity

Remove power

Numbe	Label	Type	mC	α	τ	Area	QS	QA	QE	QI	T0 [C]	T [C]	RCTime	Imbalance
4	10	PANEL									20.00	20.00	0.00e+00	-2.69e-01
5	20	UNIT BOX	1.00e+04								0.00	18.66	0.00e+00	-1.12e-06
6	30	UNIT RADIATOR	1.00e+03			2.00e+00	1.00e+00	1.00e+00	0.00e+00		0.00	-34.03	0.00e+00	-1.45e-06
7	9999	Space									-269.00	-269.00	0.00e+00	9.27e+00

- SCREENSHOT FROM LIVE DEMO -



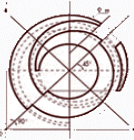
ThermXL Overview



ThermXL Analysis		(The Transient solver will be used for the next analysis)	
Steady State Parameters		Iteration Status	
Max. No. Iterations	100	Iteration Count	6
Convergence Criterion	1.00e-03	Convergence	6.12e-04
Damping Factor	1.00	Min. Thermal Response Time	
Transient Parameters		Transient Calculation Status	
Start Time	0.0	Time_s	
End Time	144000.0	Time_m	
Output Interval	7200.0	Time_e	
Initial Timestep	600.0	Current Timestep	
16 Min. Timestep	600.0		
Max. Timestep	600.0		
Max. No. Iterations	100		
Convergence Criterion	1.00e-03		
Max. Delta T [C] per Timestep	1.00e+10		
Damping Factor	1.00		

Set control values for transient run.

- SCREENSHOT FROM LIVE DEMO -

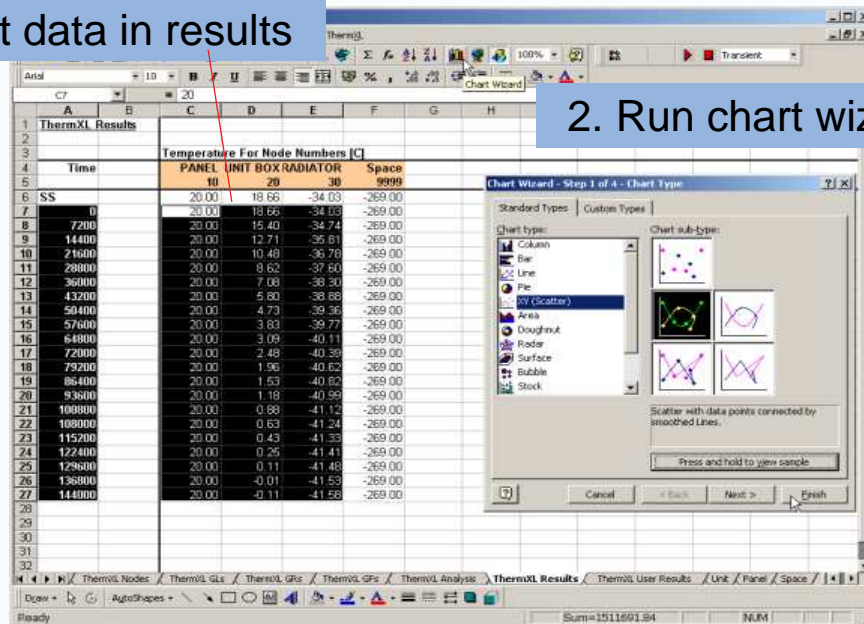


ThermXL Overview

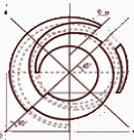


1. Select data in results

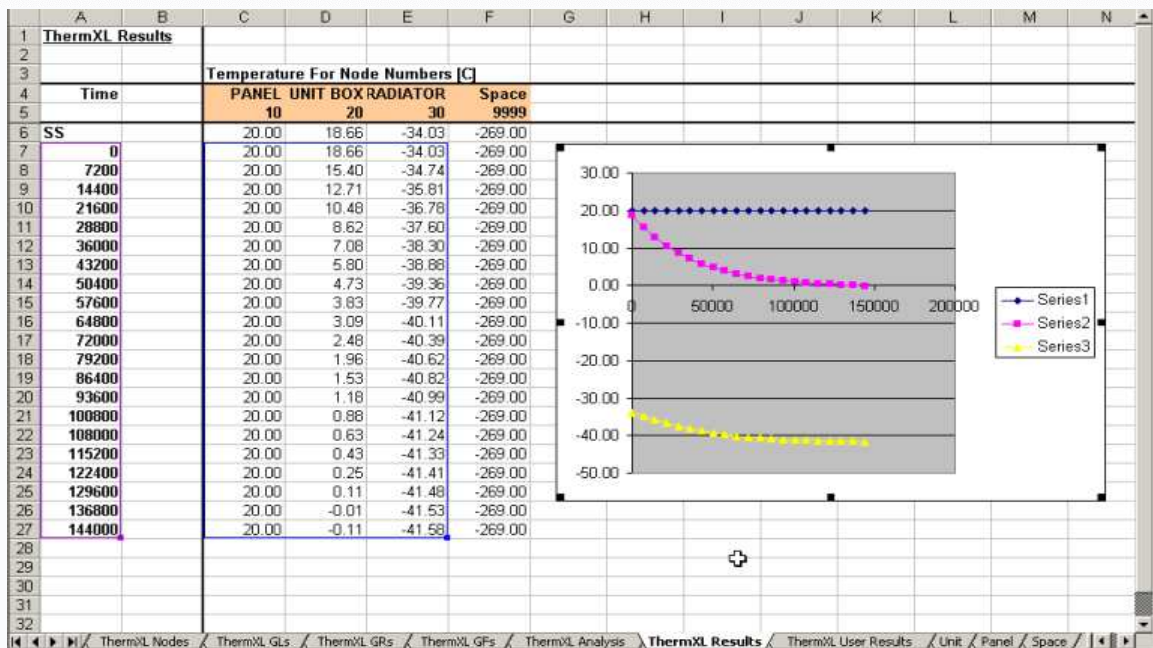
2. Run chart wizard...



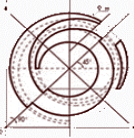
- SCREENSHOT FROM LIVE DEMO -



ThermXL Overview

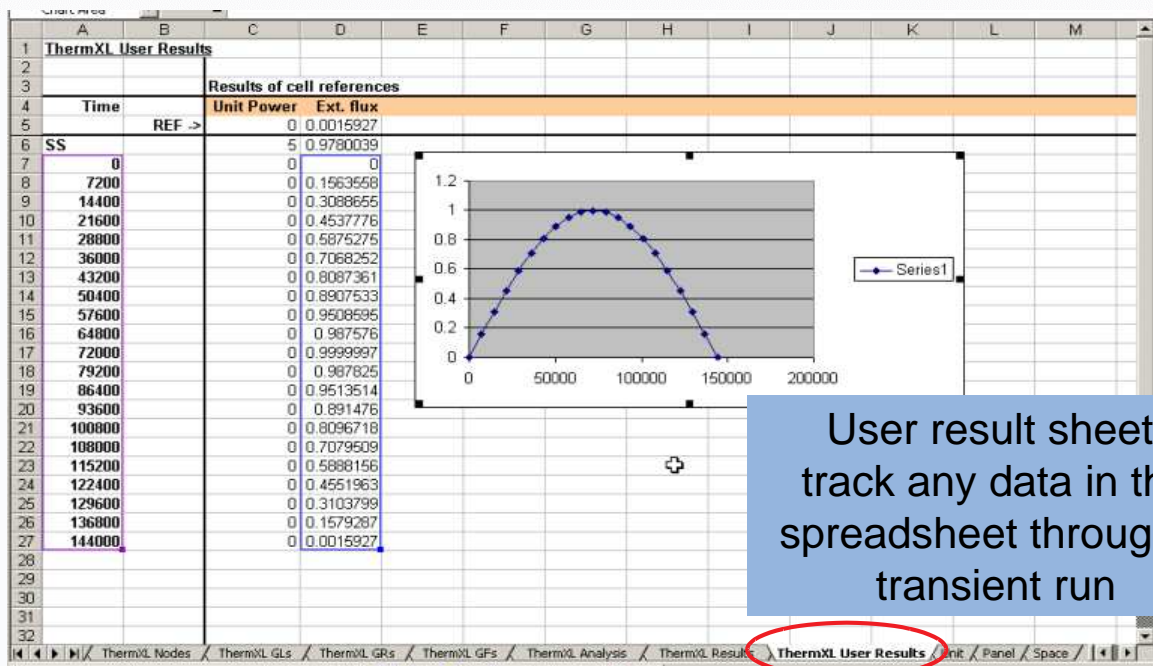
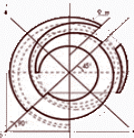


- SCREENSHOT FROM LIVE DEMO -

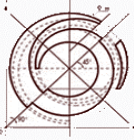


- User Defined Transient Results
- Macro access to ThermXL functions
- ESATAN & SINDA/G network export
- Node Heat Balance
- “Tidy up”
 - reformatting
 - commented control const.

--



User result sheet:
track any data in the
spreadsheet through a
transient run

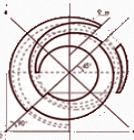


ThermXL Overview

ALSTOM

```
# ThermXL Export File for Workshop1 (17/10/2002 17:34:37)
#
# Cells containing formulas are exported as value only
# and the content is provided as a comment.
#
$MODEL JustInCase
#
$NODES
#
B10 = 'Panel', T = 20.00;
D20 = 'Box', T = 0.00, C = 1.00e+4, QI = 5.00e+0;
D30 = 'Radiator', T = 0.00, C = 1.00e+3, QS = 2.00e+0, QA = 1.00e+0, QE = 1.00e+0;
B9999, T = -269.00;
#
$CONDUCTORS
#
GR(30, 9999) = 5.00e-2;
GL(10, 20) = 2.00e-1;
GL(20, 30) = 1.00e-1;
#
$CONSTANTS
#
$CONTROL
#
# Steady-state parameters
NLOOP = 100;
RELXCA = 1.00e+0;
DAMPT = 1.00e+0;
# Preferences
TABS = 2.731500e+2;
STEFAN = 5.670510e-8;
#
$EXECUTION
#
CALL SOLVIT
#
$OUTPUTS
#
FORMAT = 'E10.2'
CALL PRPBAL(' ', CURRENT)
CALL PRNDTB(' ', 'T,C,QS,QA,QE,QI', CURRENT)
#
$ENDMODEL JustInCase
```

- SCREENSHOT FROM LIVE DEMO -

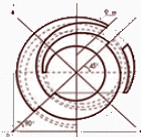


In Development for v3

ALSTOM

- Sensitivity Analysis
- Import of ESARAD data
- Built-in interpolation routines.
- Performance Improvements

- Ongoing Development -



Summary

ALSTOM

- Very easy to learn
- Rapid model development
- Well suited as a basis for 'what-if' analyses & concept development

- ThermXL v2 : Download *free* 60 day trial from:
www.techcentreuk.power.alstom.com

- Simple, Fast Spreadsheet Analysis Tool -

The ALSTOM logo is displayed in a large, stylized font. The letters 'ALSTOM' are in blue, and the 'O' is a red circle with a white center. The logo is set against a white background that is part of a larger graphic with a red and blue curved shape.

ALSTOM

www.alstom.com