T H E R M O P T I M ®

USING

THE EXCEL

POST-PROCESSING MACRO

CONTENTS

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For a single Thermoptim diagram file, there are numerous possible project files corresponding to different parameters settings for the model. In the Standard version and higher, there is a function enabling you to perform sensitivity studies, but it can keep track of only a small number of parameters.

Let's look at the structure of the Thermoptim project files (figure below). The parameter settings are placed in text fields separated by tabs, so each appears in a specific cell if the file is opened in a spreadsheet program. As you can see in the figure below, each cell contains either a value (the enthalpies of the points are given in column F, from line 25 to 29), or an "identifier=value" pair (like cells J38 and K38, which give the air factor and the combustion temperature of the combustion chamber).

	A	B	C	D	E	F	G	H	I	J	K	
12												
13	GAZ COMPOSES	1										
14	Nom du gaz / Compo	fraction molaire	fraction massique									
15												
16	gaz_brulés	5										
17	CO2	0.0300102171	0.0461435625									
18	H2O	0.0558075615	0.0351258346									
19	O2	0.146182519	0.163426215									
20	N2	0.759252709	0.743095723									
21	Ar	0.008746993359	0.0122086651									
22												
23	POINTS	5										
24	nom	nom corps	T (°C)	P (bar)	titre	h (kJ/kg)	u (kJ/kg)	V (m3/kg)				
25	combustible	gaz_de_Montoi	15	20	1	-20.52071046	-16.0726432	0.0650614508	open_syst=true	calc_pT=true	set_Tsat=false	DTsat
26	entrée d'air	air	15	1	1	-9.87037072	-7.0423588	0.827301151	open_syst=true	calc_pT=true	set_Tsat=false	DTsat
27	2	air	494.07412109	20	1	488.71623507	353.99832579	0.110138018	open_syst=true	calc_pT=true	set_Tsat=false	DTsat
28	3	gaz_brulés	1150	20	1	1295.0479224	968.22460531	0.206691821	open_syst=true	calc_pT=true	set_Tsat=false	DTsat
29	4	gaz_brulés	494.00087891	1	1	505.53960073	369.26492936	2.22834995	open_syst=true	calc_pT=true	set_Tsat=false	DTsat
30												
31	TRANSFOS	6										
32	nom	point amont	point aval	type	m ?H	type_ener	débit					
33	sortie gaz	4	4	Exchan	0	other	1.01701206	open_syst=tr	set flow=false	calc_direct=fals	min pinch DT=0	pinch
34	entrée d'air	entrée d'air	entrée d'air	Exchan	0	other	1	open_syst=tr	set flow=false	calc_direct=fals	min pinch DT=0	pinch
35	combustible	combustible	combustible	Exchan	0	other	0.0170120605	open_syst=tr	set flow=false	calc_direct=fals	min pinch DT=0	pinch
36	compresseur	entrée d'air	2	Compre	498.59	useful	1	open_syst=tr	set flow=false	rend=0.85	isentr=false	calc_(
37	turbine	3	4	Expans	-802.94	useful	1.01701206	open_syst=tr	set flow=false	rend=0.85	isentr=false	calc_(
38	chambre de combust	2	3	Combus	828.36	purchased	1.017012	open_syst=tr	set flow=false	lambda=3.5241	Tfluegas=1423.15	dissol

Figure 1: Screen shot of a Thermoptim project file

With the Excel file MacroPostTraitementRef.xls located in the "special" menu of the installation directory, you can readily post-process a group of similar project files relating to a single model. This file has two macros that enable you to load the project files, then extract selected values. These can be simple values or "identifier=value" pairs. Below are instructions on how to use the macros.

Start by closing all open windows in Excel, then open the spreadsheet MacroPostTraitement.xls and click on the left-most worksheet called "macro". In the example below, the print area in the macro worksheet is lines 4 to 10. The rest are explanations on how to use the macro, in French and English.

There are two steps involved:
- First, you load the different project files in the spreadsheet program,
- Then you define the values to be extracted and run the extraction macro.

Loading the project files in the spreadsheet

1) Open the file explorer in your operating system (Windows in this example) and place the window just above the MacroPostTraitement.xls spreadsheet.
2) Select the files you want to process;
3) Drag them to the MacroPostTraitement.xls spreadsheet; They will each open as separate worksheets;
4) In each file, click on Edit/Move or copy a worksheet" and choose MacroPostTraitement.xls as the destination spreadsheet. Make sure you place them to the right of the worksheet called "graph".
5) Arrange the worksheets in a logical order, if necessary.

You can also replace steps 4 and 5, which can be time-consuming when there are a lot of worksheets to load, by clicking on the button "load the projects", which will automatically load the projects. However, you will not be able to change the order in which the worksheets are arranged.

The project files thus automatically appear as worksheets in the spreadsheet, identified by their name without the extension. In this example, we are assuming that there were no worksheets to the right of the "graph" worksheet. You should delete any worksheets relating to another project.

	A	B	C	D	E	F	G	H	I	J	K
1	All worksheet on the right of worksheet "graph" will be taken into account, but you may add any number of sheets you may wish on its left, provided you do										
2	The names of the worksheets will appear as the column titles in the "graph" sheet										
3											
4	number of lines	22			Enter here the number of values to be extracted						
5											
6	T air inlet	C24			From line 6 to line (6 + number of lines), enter in column A the title of the value,						
7	T air outlet	C25			and in column B its reference in the worksheets						
8	water inlet	C26									
9	water outlet	C27									
10	2	C20				extract				Charger les projets	
11	3	C21									
12	4	C22									
13	1	C23									
14	Pevap	D22		Pour charger les différents fichiers de projet, opérez comme suit :							
15	Pcond	D21		1) faites-les glisser depuis leur répertoire jsuqu'à la macro : ils s'ouvrent tous comme feuilles indépendantes							
16	m refrig	G37		2) cliquez sur le bouton "Charger les projets"							
17	DH compr	E37									
18	DH evap	E39		ou bien							
19	DH cond	E38		1) faites-les glisser depuis leur répertoire jsuqu'à la macro : ils s'ouvrent tous comme feuilles indépendantes							
20	UA evap	P48		2) placez-vous successivement dans chacune des feuilles ouvertes, et utilisez la commande "Edition/Déplacer ou copier une							
21	UA cond	P47		en choisissant comme classeur de destination celui qui contient la macro							
22	N pump	K53		3) si ce n'est pas déjà fait, classez les feuilles dans un ordre logique							
23	epsi cond	M47		cette seconde manière de faire est plus lente, mais vous permet de contrôler le placement des différentes feuilles							
24	epsi evap	M48									
25	DT srefr	L21		Pour extraire les informations désirées :							
26	air inlet	G36		1) entrez colonne A, à partir de la ligne 6, les intitulés que vous souhaitez voir apparaître dans "graph"							
27	rend isentr	J37		2) entrez colonne B la référence de leur cellule dans les feuilles des différents projets							
28				3) lorsque vous avez terminé votre sélection, entrez cellule B4 le nombre de valeurs à extraire							
29				4) cliquez sur le bouton "extract"							
30											
31				Toutes les feuilles à droite de "graph" seront prises en compte, mais vous pouvez en ajouter d'autres à gauche							

Figure 2: Worksheet where the cells to be extracted are defined

Defining the values to be extracted and running the macro

To extract the desired information:
1) In column A, starting at line 6, enter the labels you want included in the post-processing worksheet "graph";
2) In column B, enter the cell reference in the project worksheets;
3) When you have finished, enter the number of values to be extracted in cell B4 (outlined);
4) Click on the button "extract".

In the example above, we wanted to extract the energies used in three processes (the compressor work, the turbine work, and the heat released in the combustion chamber in cells E36 to E38, see the figure showing the project file), as well as the temperature of points 2 and 4 (compressor and turbine outlets, cells C27 and C29, see the figure). As there are 5 values to be extracted, we enter 5 in cell B4.

Once the values to be extracted are selected, run the macro by clicking on the "extract" button. The macro runs through all the worksheets located to the right of the worksheet "graph" and copies the values of the selected cells, building the table shown in the figure below.

Note: We recommend configuring your machine so that the decimal separator is the period and not a comma, by selecting English as the regional option. Otherwise errors may occur in reading the values.

	A	B	C	D	E	F	G	H
1								
2								
3								
4		TAG4	TAG8	TAG12	TAG16	TAG20	TAG24	TAG28
5								
6	travail compresseur	171,82	292,23	376,21	442,71	498,59	547,21	590,
7	travail turbine	-439,1	-613,53	-702,9	-760,94	-802,94	-835,4	-861,
8	chaleur chambre de combustion	1186,18	1054,33	962,36	889,54	828,36	775,12	727,
9	T2	184,9920898	301,2274414	381	442,6214844	494,0741211	538,4222656	577,53359
10	T4	808,9789063	663,6297852	586	533,0755859	494,0008789	463,0560547	437,64101

Figure 3: Values extracted by the macro

Each line corresponds to one of the values selected, and each column corresponds to one of the worksheets.

Post-processing

Once the values are extracted, you can access the normal features of Excel, for post-processing.

Specifically, on line 5 or lower, you can enter the value of the parameter that has been modified from one project file to another (the macro has no way to determine this automatically). In this case, it was the compression ratio, concatenated to the character string "TAG" in the file name.

You can easily recalculate the machine's effectiveness and power values based on the extracted values, and plot the evolutions of all of these parameters as a function of the compression ratio, or for example, the evolution of the effectiveness as a function of the power (figures 4).

|	A	B	C	D	E	F	G	H
1								
2								
3								
4		TAG4	TAG8	TAG12	TAG16	TAG20	TAG24	TAG28
5		4	8	12	16	20	24	
6	travail compresseur	171,82	292,23	376,21	442,71	498,59	547,21	590,
7	travail turbine	-439,1	-613,53	-702,9	-760,94	-802,94	-835,4	-861,
8	chaleur chambre de combustion	1186,18	1054,33	962,36	889,54	828,36	775,12	727,
9	T2	184,9920898	301,2274414	381	442,6214844	494,0741211	538,4222656	577,53359
10	T4	808,9789063	663,6297852	586	533,0755859	494,0008789	463,0560547	437,64101
11								
12	rendement	0,225	0,305	0,339	0,358	0,367	0,372	0,3
13	puissance	267	321	327	318	304	288	2

Figure 4: Post-processing
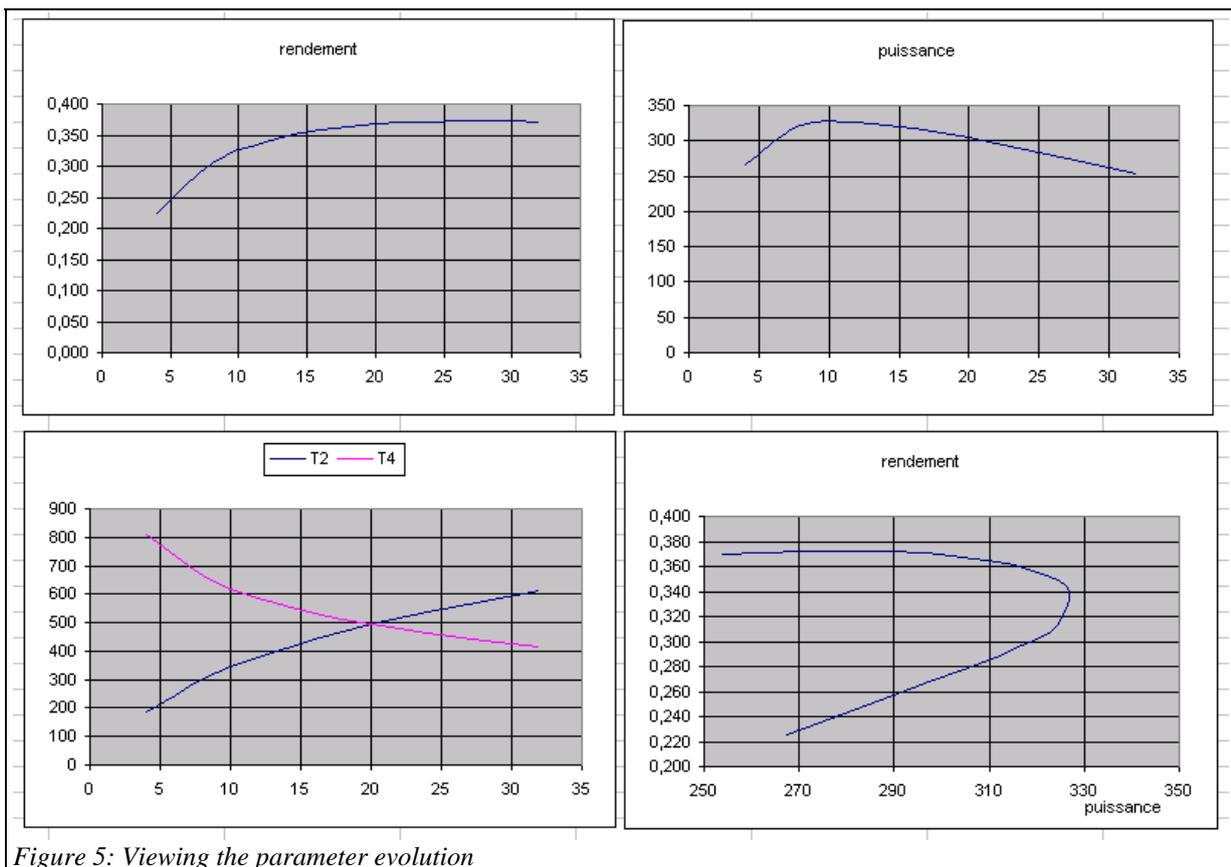
Figure 5: Viewing the parameter evolution

As worksheet "graph" has no link with the other sheets, you may copy its content in another spreadsheet for backup.