Notebook software for figuring with polishing machine

(Excel spreadsheet : Figuring_notebook.xls)

Install :

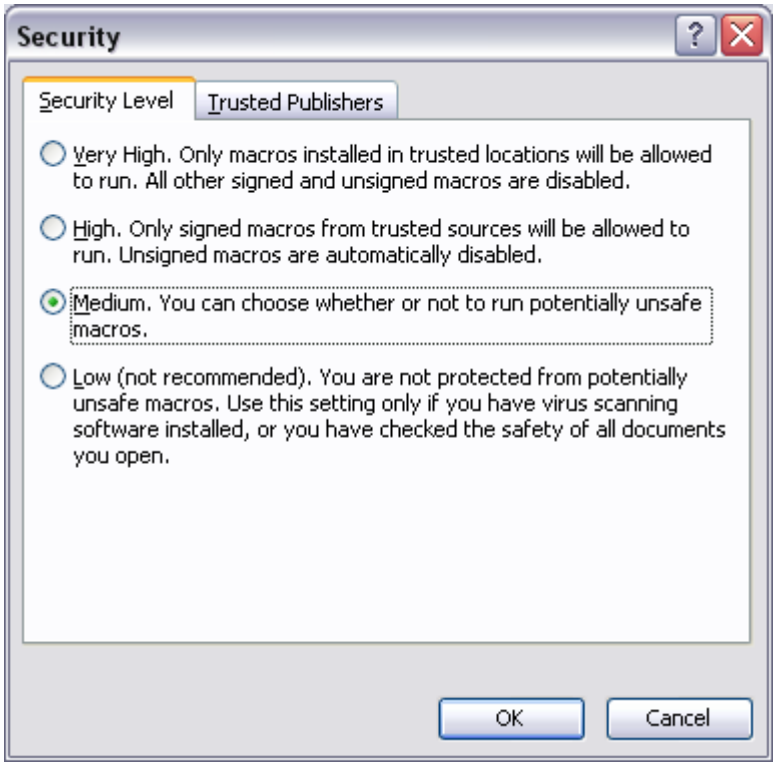
The installation is done by copying the file to the chosen directory.

Enable macros :

The spreadsheet works with Macros. Depending on the level of protection set in Excel, they may not work. It is therefore necessary to define a level of protection enabling the use of these macros.
To do this, click the following commands :

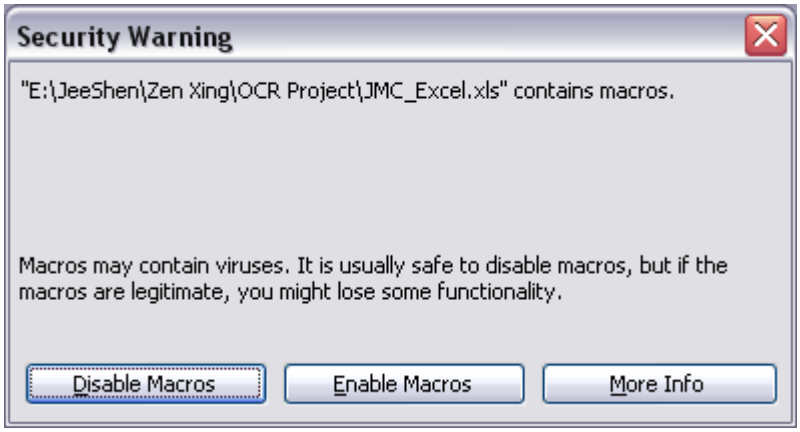
For Excel 2000 and 2003 :

Tools / Macro / Security



Select « Low » to allow enabling macros without a warning message.

If "Medium" is selected, the following message will appear after the opening of the spreadsheet :

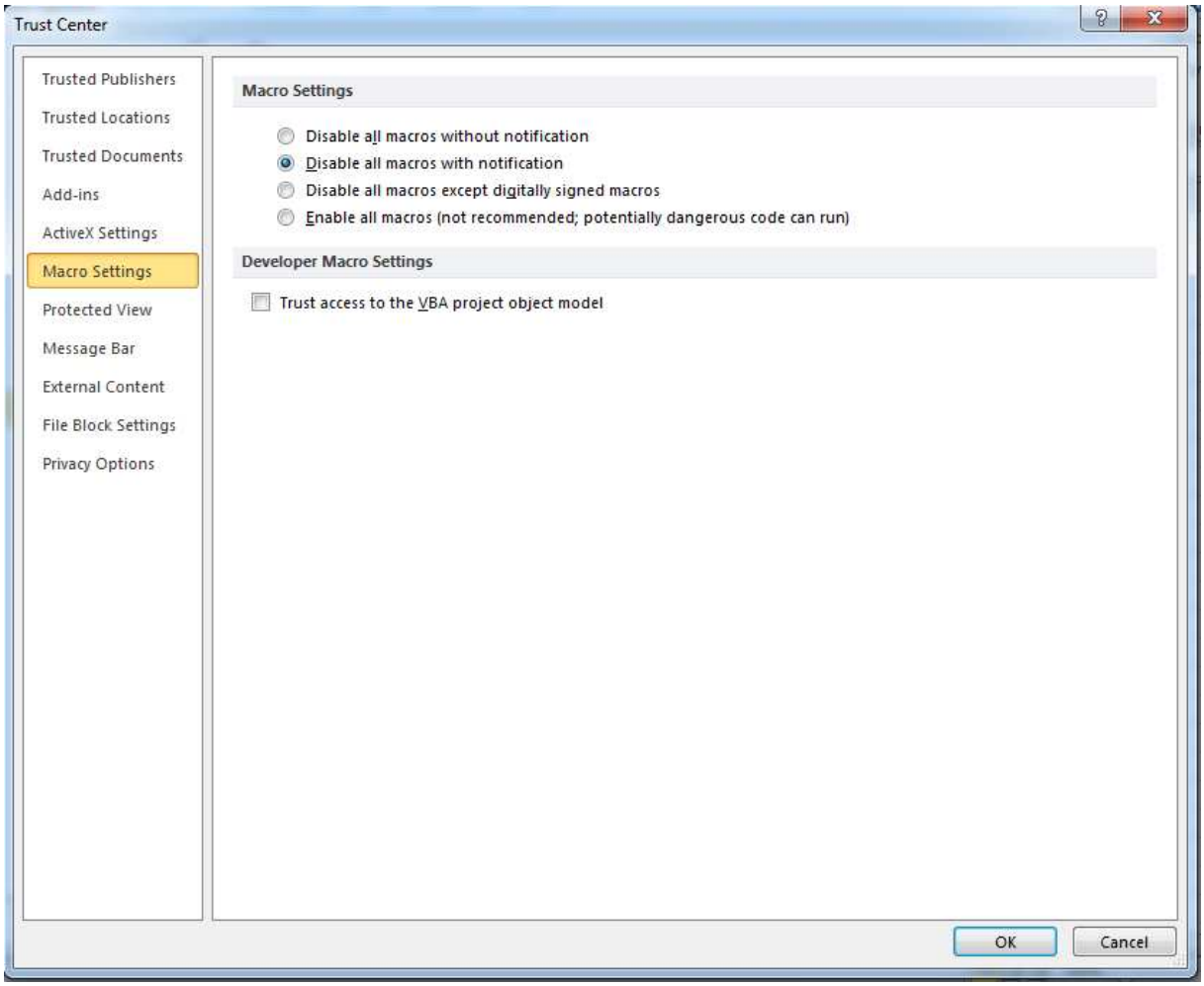


You will need to click "Enable Macros" to benefit from all the functions of the software.

For Excel 2007, 2010 and 2013 :

Click the Microsoft Office Button, then click on « Excel Options » (Excel 2007)
or
File / Options (Excel 2010 and 2013)

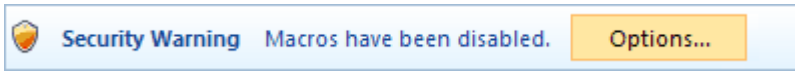
Select « Trust Center » then click on « Trust Center Settings …» and finally on « Macros Settings » :



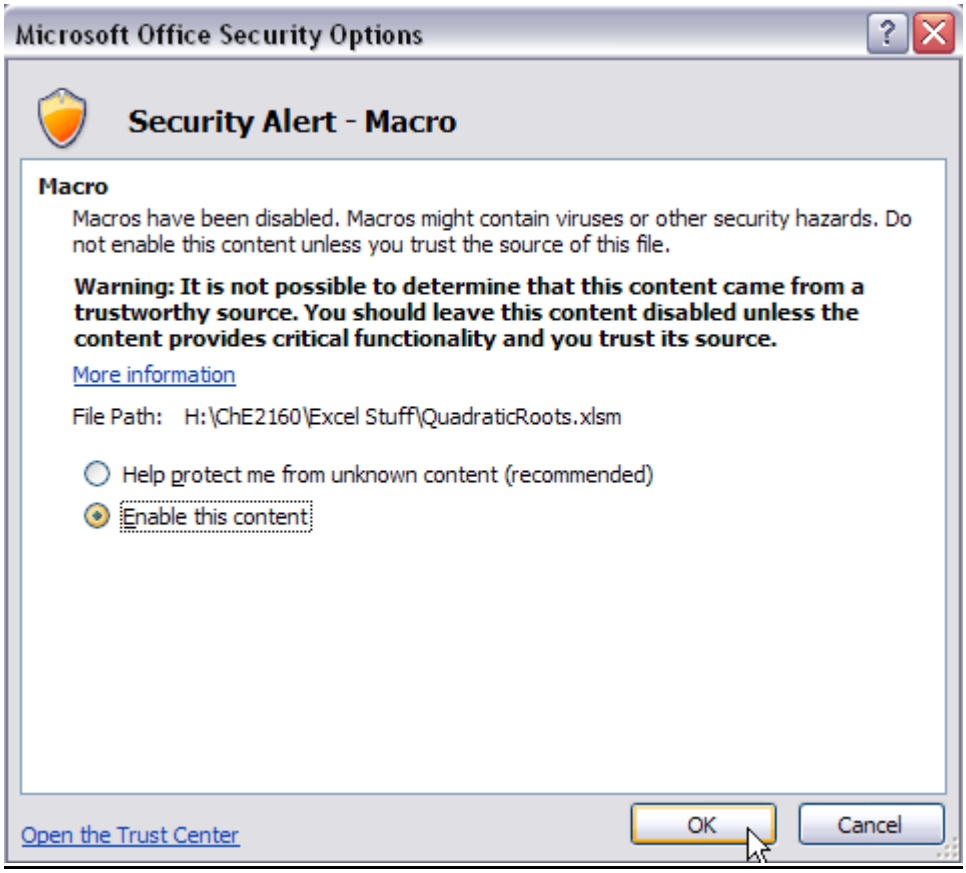
Select « Enable all macros » to allow enabling macros without warning message.

If "Disable all macros with notification" is selected, a security warning will appear after opening the spreadsheet :

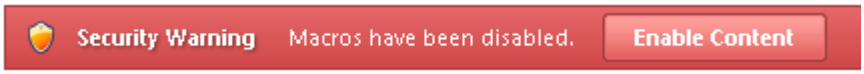
Excel 2007 :
The banner below appears below the Ribbon :



Click on the "Options" button in the message and check "Enable this content" in the window below and then OK to enable macros.



Excel 2010 and 2013 :
The banner below appears below the Ribbon :



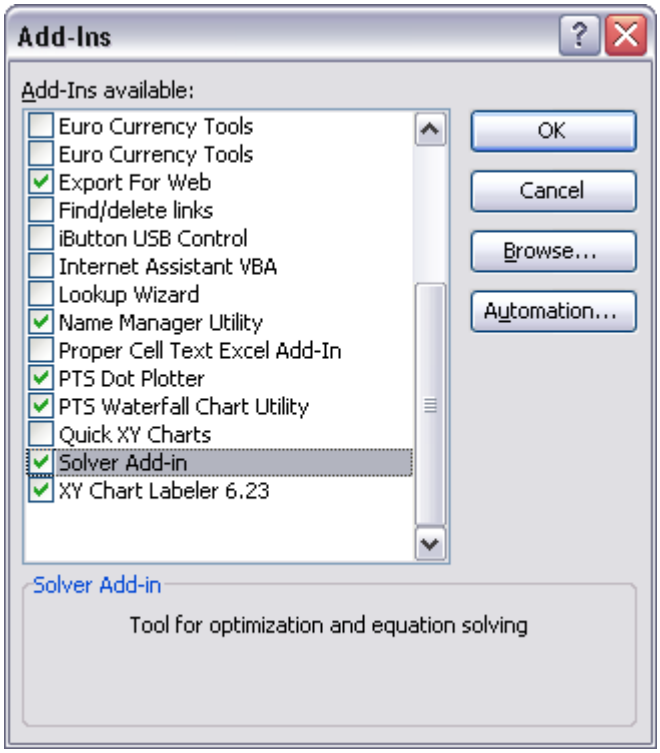
Just click "Enable this content" to allow macros.

Install Excel Solver:

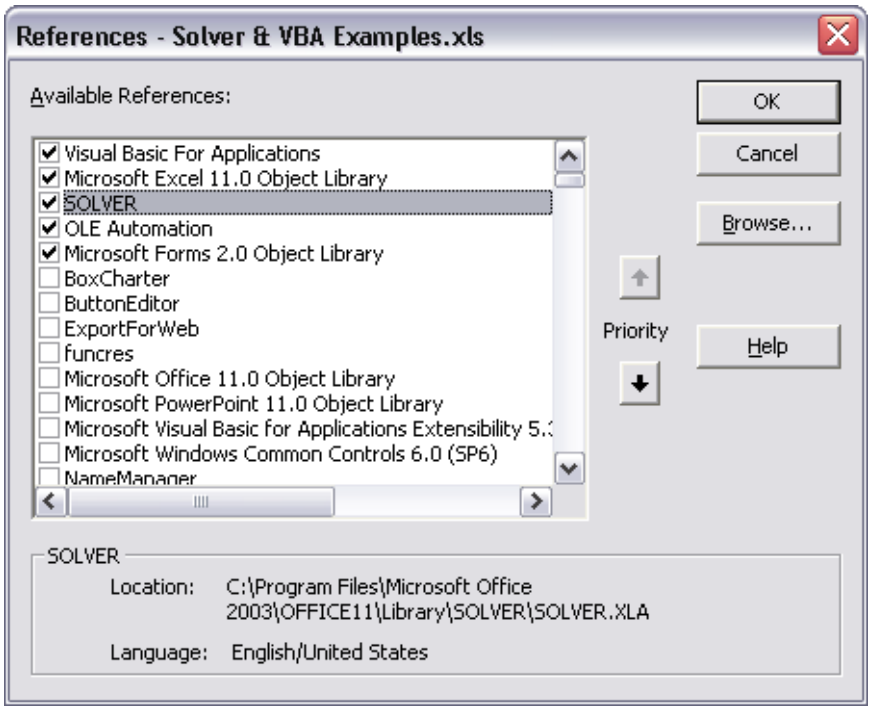
The spreadsheet uses the Excel Solver tool for treating complex algorithms.
The Solver add-in is not necessarily installed by default. The procedure to install it is as follows :

Excel 2000 and 2003 :

Tools / Add-Ins …
Select « Solver Add-in » if this option is not checked
Insert the original Excel installation CD (or specify the directory of installation files) to install the Solver Add-in.



ust then verify that the Solver is referenced in Visual Basic for Excel. It is therefore necessary to first enter the Visual Basic Editor:
Tools / Macro / Visual Basic Editor
And then :
Tools / References : check SOLVER



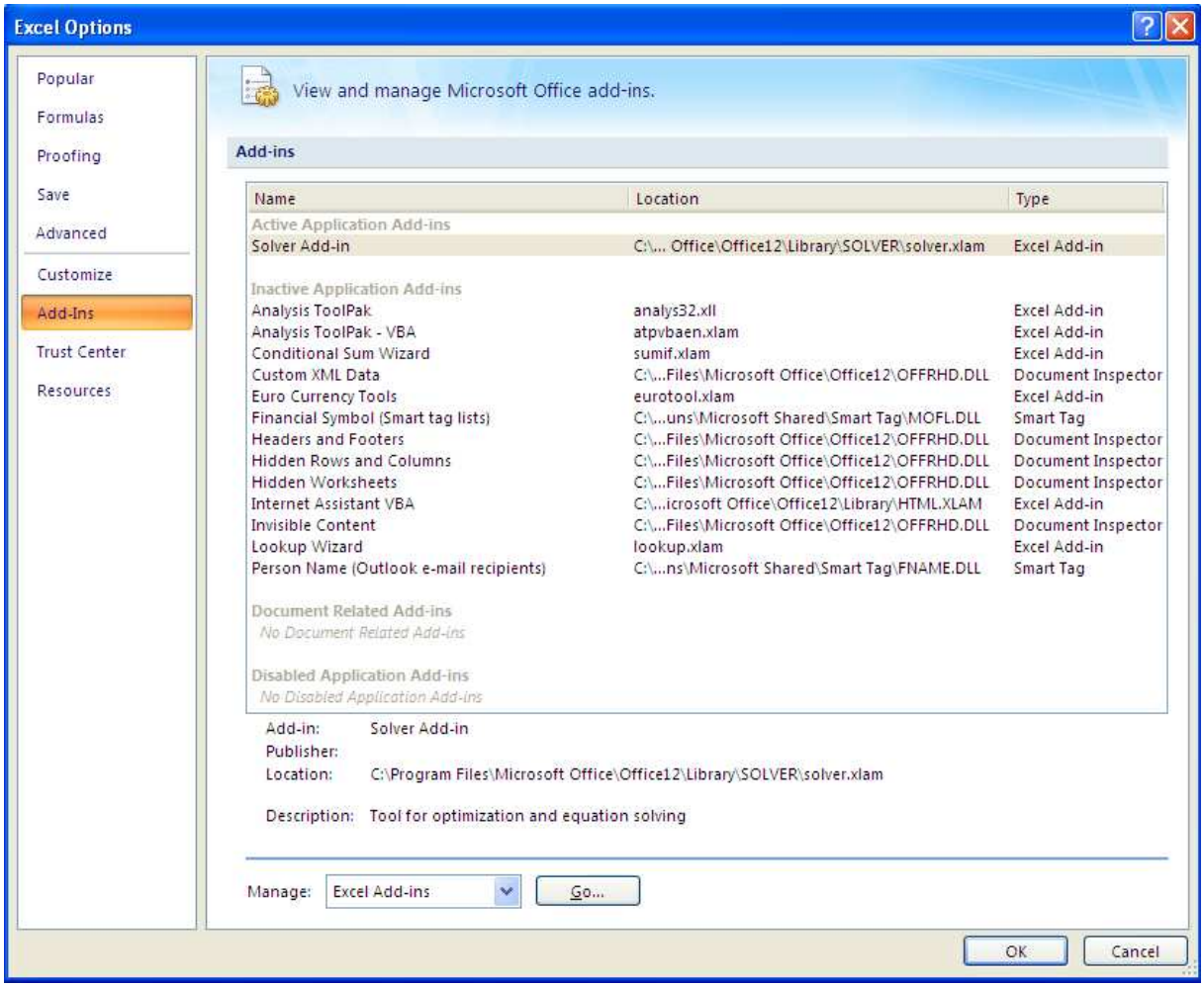
The spreadsheet is now ready to operate.

Excel 2007, 2010 and 2013 :

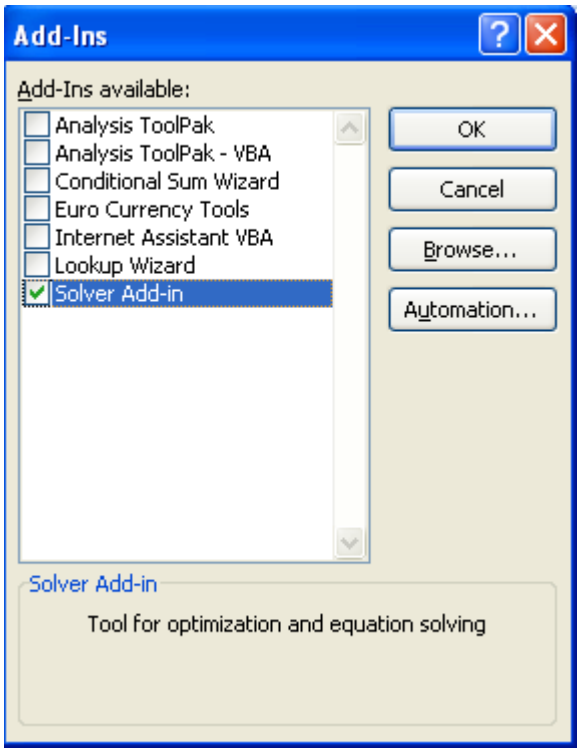
First insert the original Excel installation CD (or specify the directory of installation files) to install the Solver Add-in.

Click the Microsoft Office Button , then click on « Excel Options » (Excel 2007)
or
File / Options (Excel 2010 and 2013)

Check « Add-Ins » then, in the « Manage » zone, select « Excel Add-ins» and click on « Go… ».



In the “Add-Ins” window, check "Solver Add-in", and then click OK.



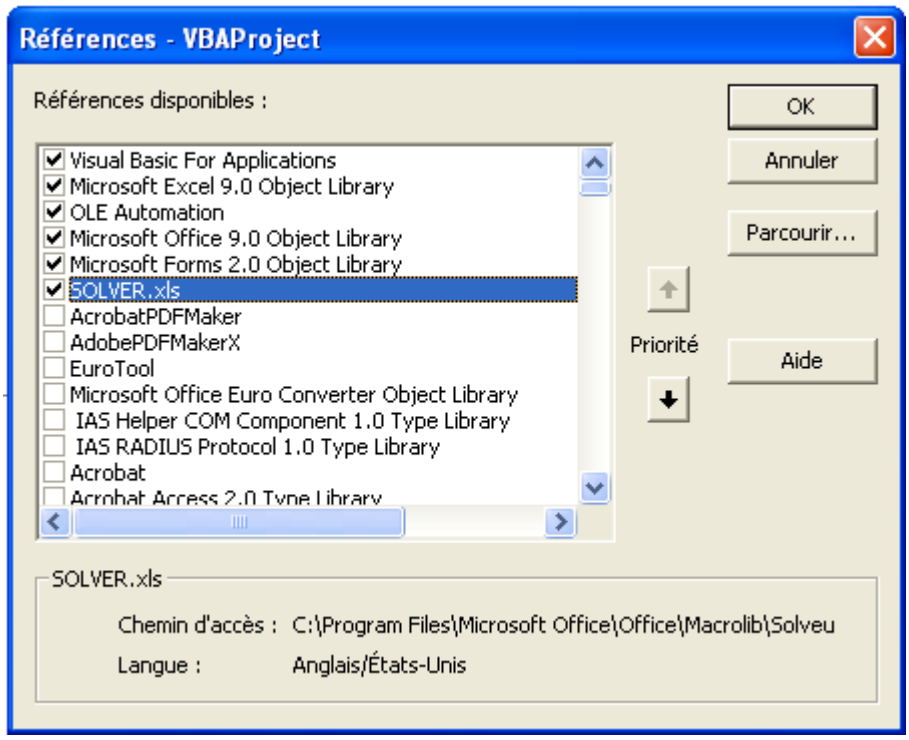
You must then reference the Solver in Visual Basic Editor through the "Developer" tab. If it is not available in the Ribbon, install it as follows :

Excel 2007 :

Click the Microsoft Office Button , then click on « Excel Options »
Click on « Popular » then, in the « Top options for working with Excel » section, check « Show Developer tab in the Ribbon » and OK.

Excel 2010 and 2013 :
File / Options
Click on « Customize Ribbon » then check « Developer » on the right table.

To reference the Solver in Visual Basic Editor :
Click on the "Visual Basic" button in the "Developer" tab
And then :
Tools / References : check SOLVER



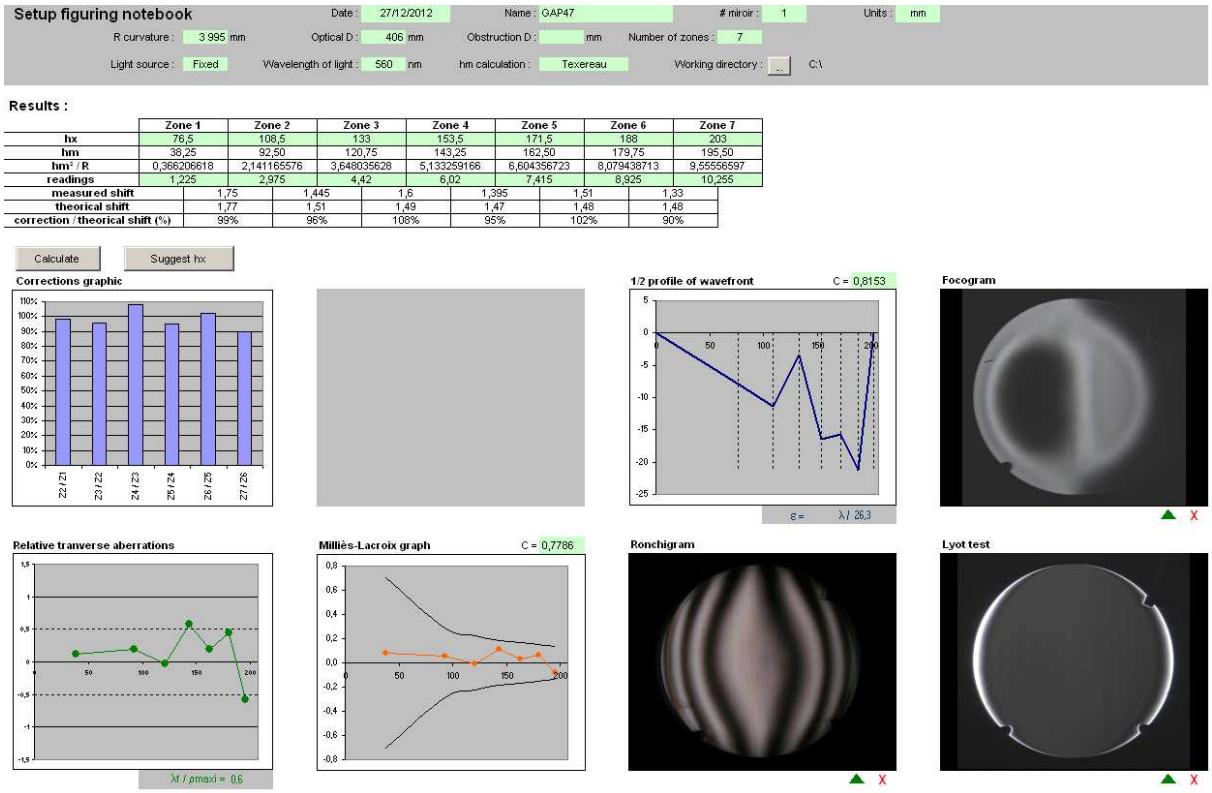
User guide:

Open the "Figuring_notebook.xls" file with your version of Excel.
The workbook contains several tabs:

- A “Setup” sheet in which you can enter the parameters of the mirror (diameter, radius, ...), of the Couder screen and enter the first measures that will serve as a starting point.
- A series of sheets for the different working sessions (maximum 50).
- A “Summary” sheet recapitulating the evolution of the results for all sessions.

Enter cells are green. The others are locked.

« Setup » sheet :



In the « Setup » sheet enter :

- the date of the first control
- the name of the operator
- the serial number of the mirror
- the unit of measurement (mm or inches)
- the radius of curvature of the mirror
- the optical diameter of the mirror
- the diameter of the possible obstruction. It must be a central area full (uncut) on the Couder screen.
- the number of zones of the Couder screen. This data is used to automatically format the input tables and graphs.
- the nature of the light source (fixed or moving)
- the wavelength used for the calculations
- the method of calculation of hm (Nils Olof Carlin or Texereau)
- the working directory where the photos to insert are stored

In the zones table :

- the outer radii of the zones (hx). These values can be suggested once the optical diameter and number of zones entered by clicking the button "Suggest hx"
- measurements for each zone. If you want to take the average of several measurements, you can enter a formula whose syntax is : =AVERAGE(value1 ;value2 ;… ;valueN)

Click on "Calculate" to see the results (numerical and graphical). These are detailed in the description of the sessions sheets below.
A final field is used to enter a text commenting on the results and the proposed strategy for the next session (overhangs, offset, size tools, durations, ...).

« Sessions » sheets :

The data entered in the "Setup" sheet are automatically offset. However, we can modify the existing contents of the cell with other values. These new data will be offset into the following sessions sheets.
In addition to the data entered in the "Setup" sheet, the following data must be entered :

- plate speed of the machine (rpm)
- added weight on the machine arm
- room temperature (°C)
- polishing powder used

You should then enter the machine data (adjustments and durations):

D tool		Duration	Left cranck		Right cranck		Offset (mm)	Overhang		Comments
mm	%	(mn)	Length (mm)	Speed (rpm)	Length (mm)	Speed (rpm)		mm	%	
200	50%	15	20		200	19	10	60	30%	
200	50%	15	20		200	19	15	64	32%	
150	38%	15	20		200	19	20	69	46%	
150	38%	15	20		200	19	25	73	49%	
		60								

The table contains as many rows as there are different settings:

- diameters of the different tools used.
  Their values are automatically calculated as a percentage of the optical diameter.
- Time sequence (in minutes) for each type of settings / parameters given.
- For each cranck (left and right): length of eccentricity and speed (rpm).
- the offset value.
- the overhang value. This is automatically calculated as a percentage of the tool diameter.
- free comments

It is possible to format the table with the number of rows you want. To do this, complete the "Number of lines" field then "Enter" and click on the "Go" button. The table can have 40 lines maximum and 10 minimum.
The measurements are then entered in the same way for the “setup” sheet.

Then click on the "Calculate" button to view the results :

Results :

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
hx	76,5	108,5	133	153,5	171,5	188	203
hm	38,25	92,50	120,75	143,25	162,50	179,75	195,50
hm² / R	0,366206618	2,141165576	3,648035628	5,133259166	6,604356723	8,079438713	9,55556597
readings	1,225	2,975	4,42	6,02	7,415	8,925	10,255

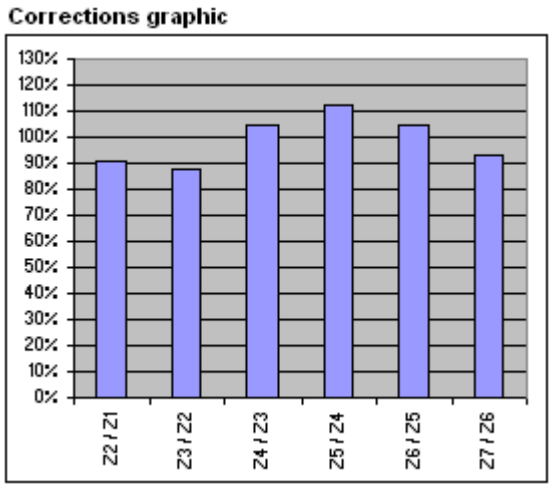
measured shift	1,75	1,445	1,6	1,395	1,51	1,33
theorical shift	1,77	1,51	1,49	1,47	1,48	1,48
correction / theorical shift (%)	99%	96%	108%	95%	102%	90%
correction / theorical shift (%)	8%	-7%	1%	20%	0%	-10%

In the table, we first calculate the hm and hm² / R (classic test data sheet). For zone#1, the calculation of hm takes into account a possible obstruction.

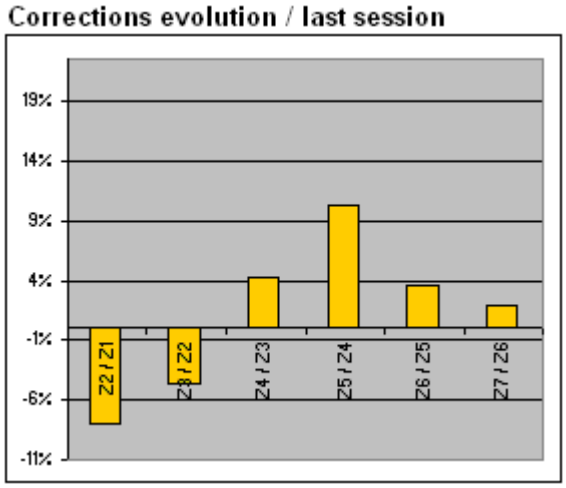
The following lines contain the calculations :

- the measured shift (the difference between the measurements of the two zones on either side of the spine)
- the theoretical shift (the difference between the hm²/R of the two zones on either side of the spine)
- correction observed in relation to theoretical shift (in %)
- evolution of the correction from the previous session (this data is particularly useful to assess the effect of the session being analyzed)

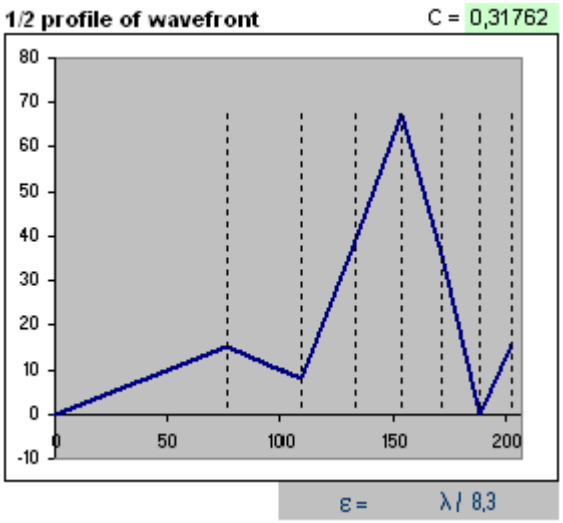
Calculations are also represented by different graphs :



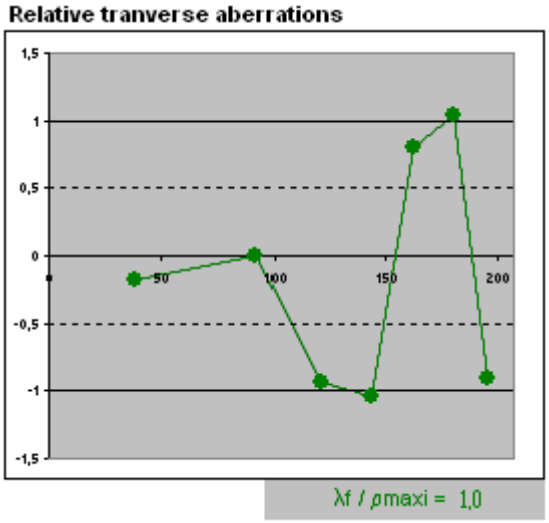
This chart shows the % of correction between each pair of zones in relation to the theoretical values (the numerical values appear in the table of results)



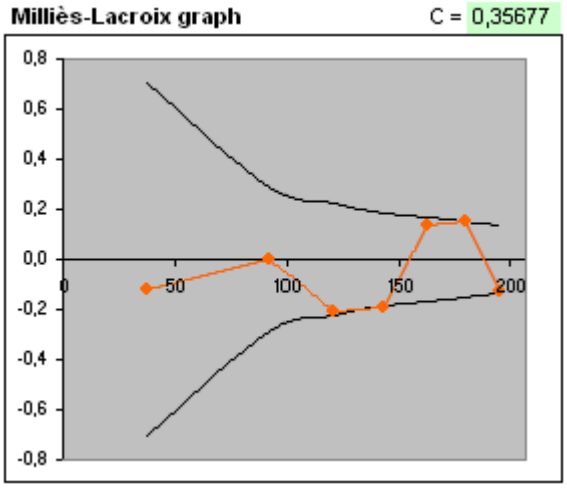
This graph shows the evolution of corrections between this and the previous session. It is easier to assess the location and extent of the effects of retouching.



This graph represents the ½ profile of the wavefront (the best reference wave is here parallel to the x-axis). The PTV value is indicated at the bottom right of the graph. It is possible to manually change the C constant to view another focus. In case of further click on the "Calculate" button, the C input value will be replaced by its optimized value.



This graph shows the values of relative transverse aberration for each zone. The calculation is optimized in the circle of least aberration that is to say, the maximum and minimum values of the aberration values are equal and of opposite signs. The absolute value of the maximum aberration is shown at the bottom right of the graph.



Although largely neglected by amateurs since the advent of software tools, representing Millies-Lacroix, however, still used by some of them. The envelope curves represent the limits aberrations corresponding to the diffraction spot. It is also possible to manually change the C constant but it is again optimized by calculating for each click on the "Calculate" button.

Other frames (in black) allow you to insert tests photographs (Foucault, Ronchi and phase contrast). To insert an image, click the ▲ icon at the bottom right of the corresponding frame. A browser window opens by pointing the directory specified in the “Setup” tab. Once the file is selected, the image will be automatically inserted into the frame. To delete the picture, click the X icon. The titles over the frames can be changed as needed.

In the last input frame "Session analysis and strategy" you can describe the analysis of the measured shape after the current session (expected effect confirmed or not, possible causes of non-achievement of objectives, ...) and the deduction in terms of the proposed strategy for the next session (machine settings, tool size, durations, ...). The completeness of the information entered in this cell as a basis for defining future strategies more or less reproduce the actions that have been effective in similar cases.

Once the session input and analyzed, we can create the following by clicking on the "New session" button. You can also delete the last session created by clicking "Remove Session".

« Summary sheet » :

Summary of sessions Date : 04/01/2013

Name : GAP47 R curvature : 3 995 mm Optical D : 406 mm Obstruction D : 0 mm

Session	Date	Duration	PTV	λf/ρ max	% corrections											
					Z2/Z1	Z3/Z2	Z4/Z3	Z5/Z4	Z6/Z5	Z7/Z6	Z8/Z7	Z9/Z8	Z10/Z9	Z11/Z10	Z12/Z11	Z13/Z12
1	17/06/09	60 mn	λ/ 8,3	1,0	91%	88%	105%	112%	105%	93%						
2	17/06/09	60 mn	λ/ 7,8	1,4	101%	113%	81%	102%	81%	112%						

Total 1 h 0 mn

This sheet allows you to view historical sessions with, for each, the date, the duration, the PTV, the relative transverse aberrations and % corrections between each zone. The total duration (in hours and minutes) also appears.