Computational Fluid Dynamics

2016 autumn, 4th week

- Tamás Benedek
- benedek [at] ara.bme.hu
- www.ara.bme.hu/~benedek/CFD/icem

The most important rule:

Dont use space or specific characters in:

File names, path, part names, etc. (nowhere)

- Working directory: C:\Work → create your own, for example: Work\quentin_tarantino (if you are Quentin Tarantino)

<u>Another important rule:</u>

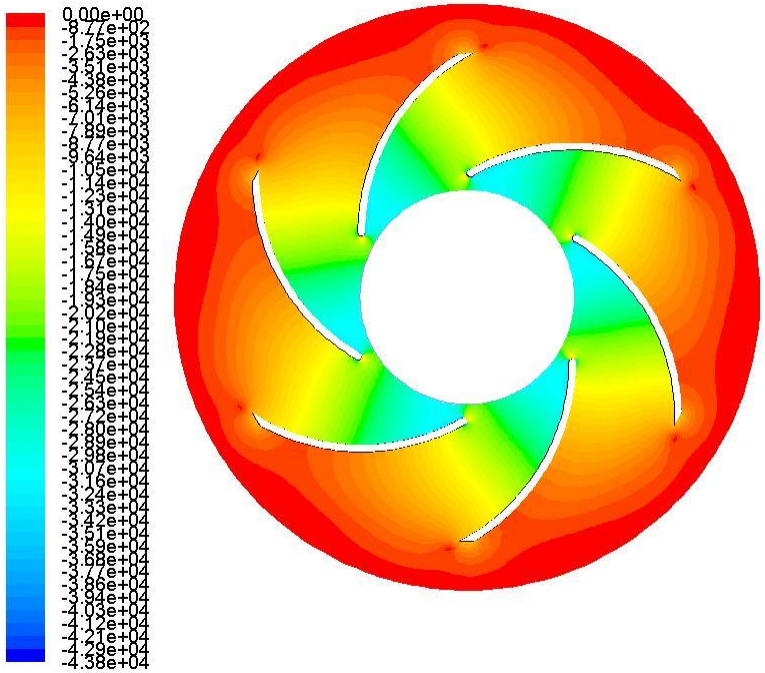
Your work will be deleted, if you turn off the computer. → When you finished, save your work on a flash drive or send it to yourself attached to an e-mail

Instructors of ICEM courses:

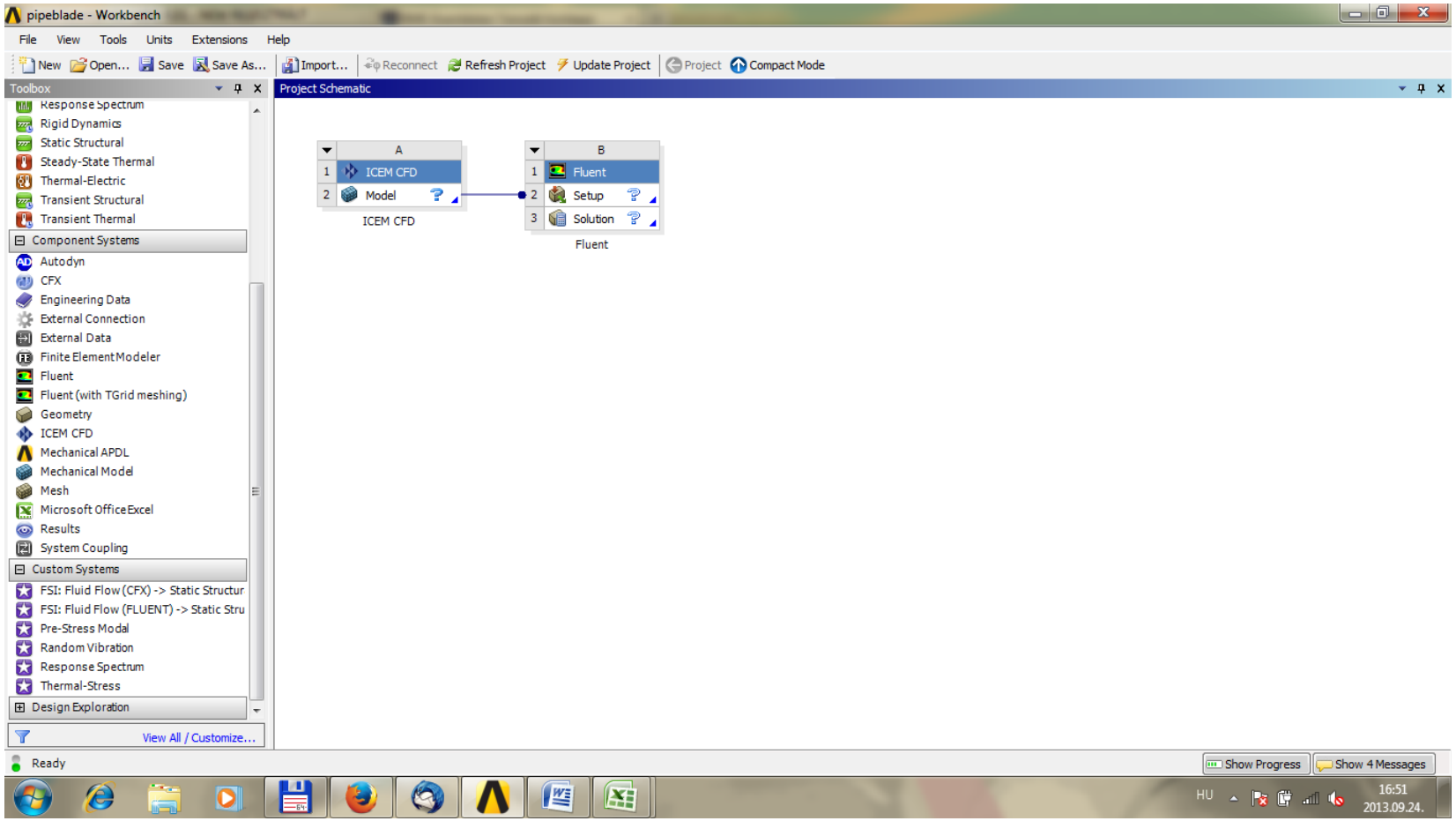
- László Nagy (nagy [at] ara.bme.hu)
- Péter Füle (fule [at] ara.bme.hu)
- András Tomor (tomor [at] ara.bme.hu)

The goal of the practice

- Simulate the flow in the blade passage of an centrifugal pump
- Learn how to create periodic boundaries in the ICEM CFD



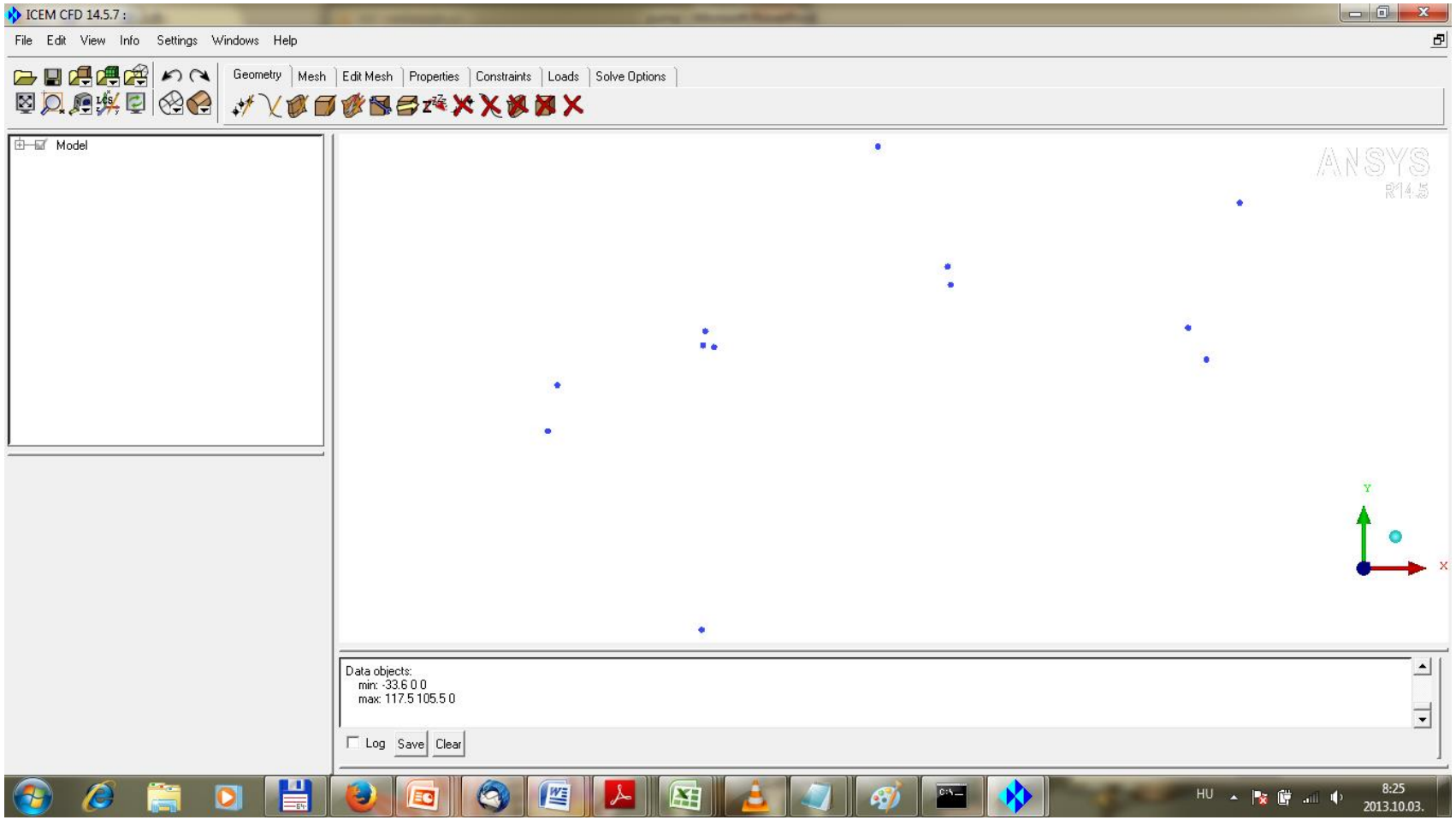
Preparation of the Workbench project



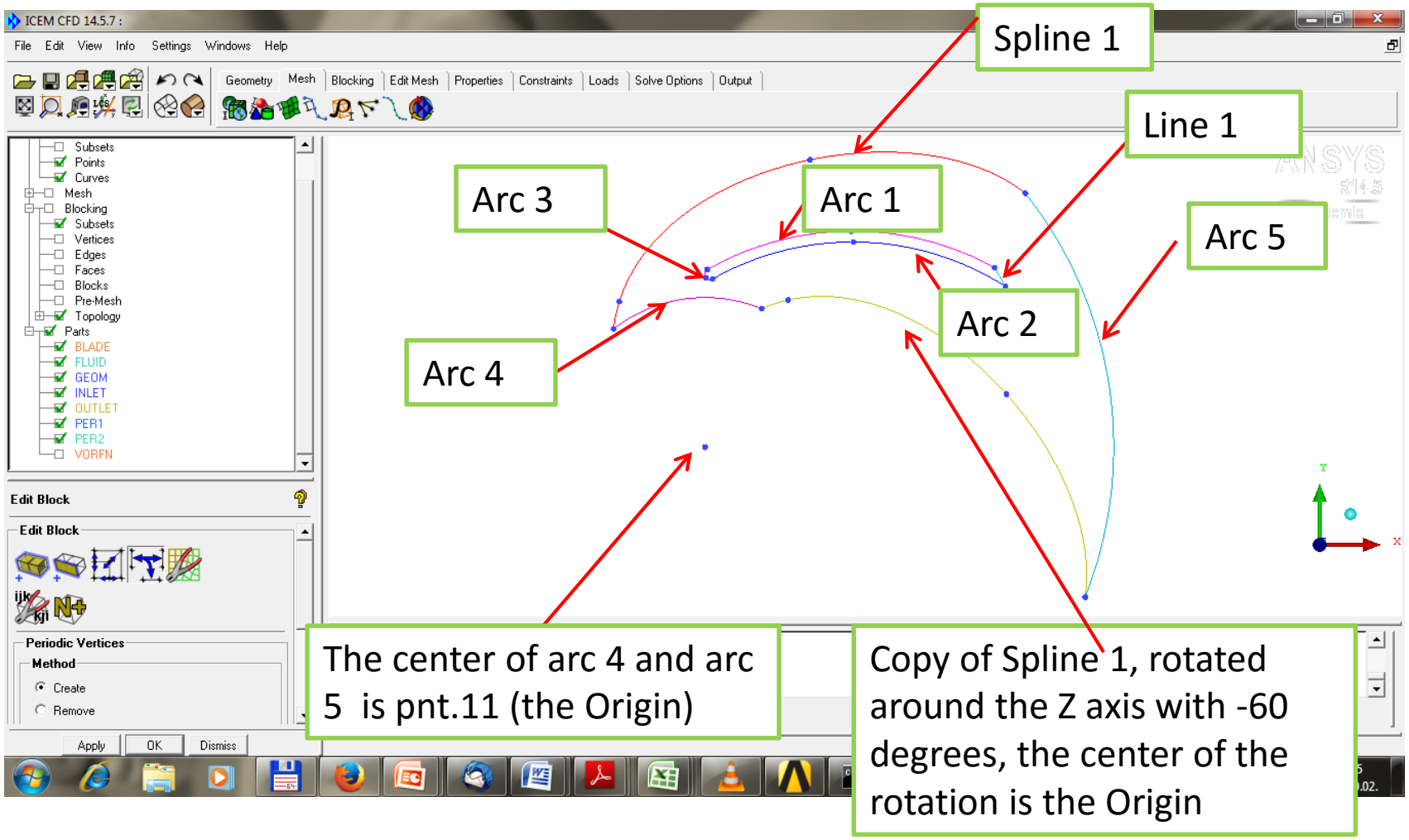
Point creation

- Download the ***pump_pnts.rpl*** script file from http://www.ara.bme.hu/~benedek/CFD/icem/icem_4th_practice/
- In ICEM CFD:
  - File → Replay Scripts → Run from script file → run the ***pump_pnts.rpl*** file

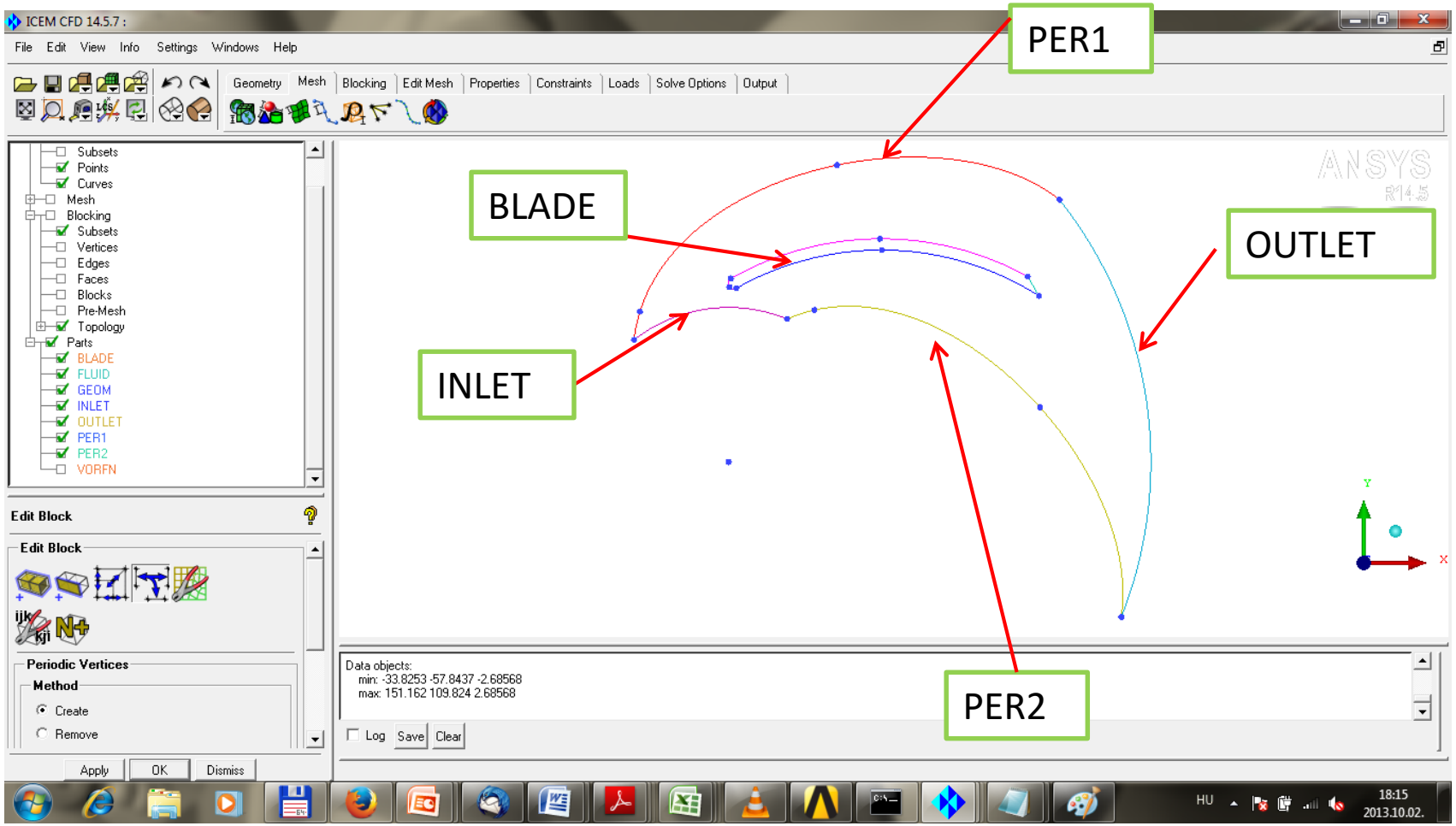
Point creation



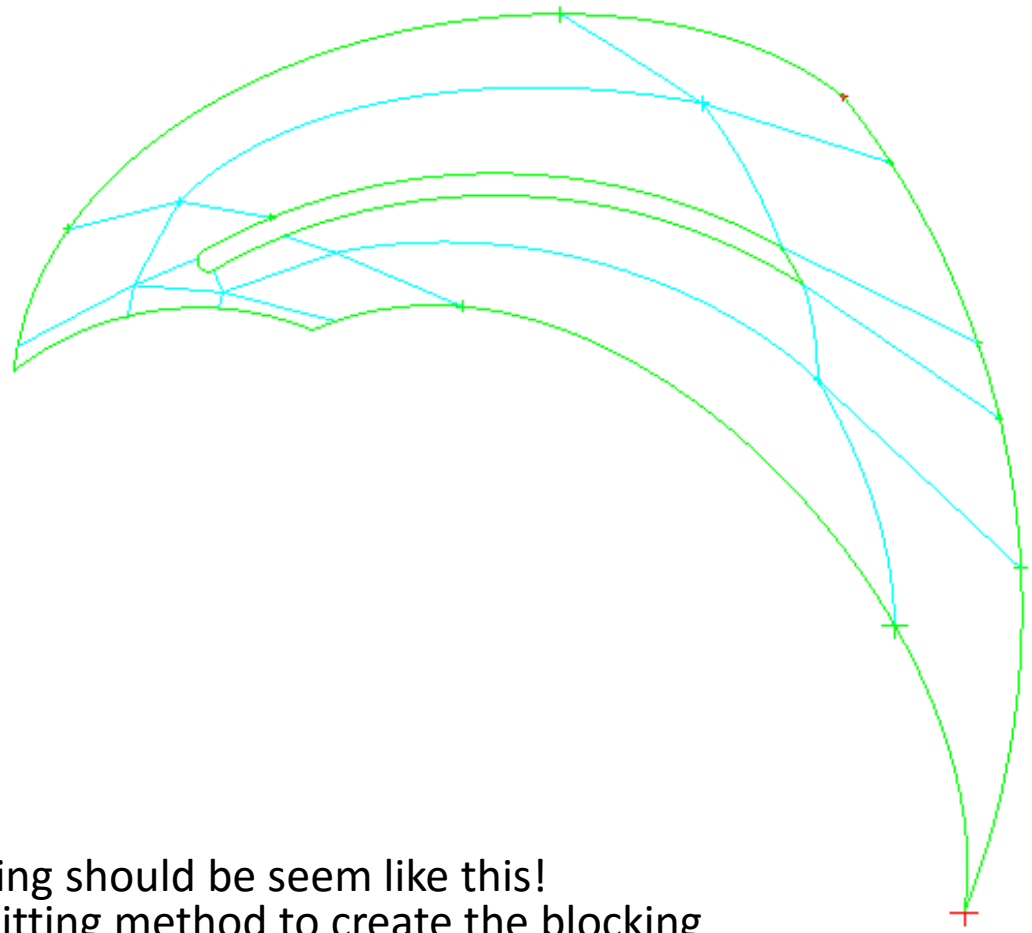
Curve creation



Parts

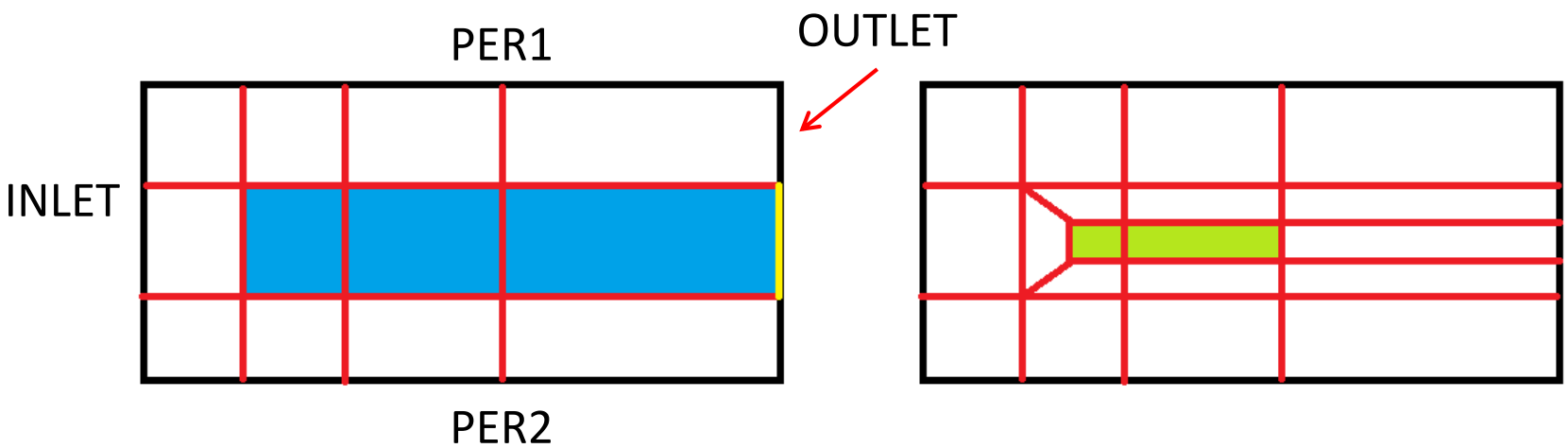

ICEM CFD 14.5.7 :
File Edit View Info Settings Windows Help
Geometry Mesh Blocking Edit Mesh Properties Constraints Loads Solve Options Output
Subsets
Points
Curves
Mesh
Blocking
Subsets
Vertices
Edges
Faces
Blocks
Pre-Mesh
Topology
Parts
BLADE
FLUID
GEOM
INLET
OUTLET
PER1
PER2
VORFN
Edit Block
Edit Block
Periodic Vertices
Method
Create
Remove
Apply
OK
Dismiss
Data objects:
min: -33.8253 -57.8437 -2.68568
max: 151.162 109.824 2.68568
Log
Save
Clear
ANSYS
R14.5
PER1
BLADE
OUTLET
INLET
PER2
HU
18:15
2013.10.02.

The Blocking



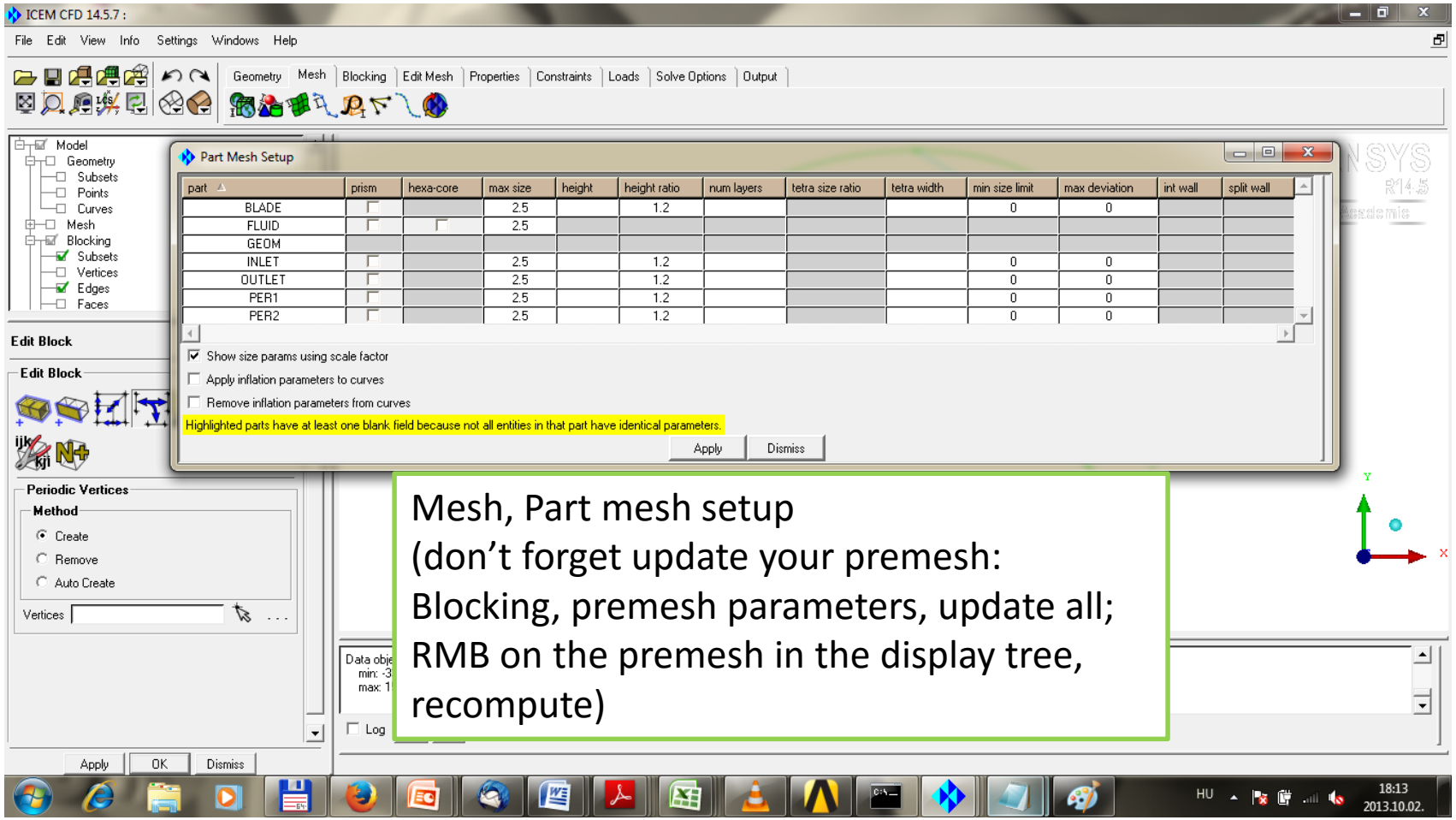
The blocking should be seem like this!
Use the O-grid splitting method to create the blocking around the blade!
The blocks in the blade should be deleted!

Blocking schematic



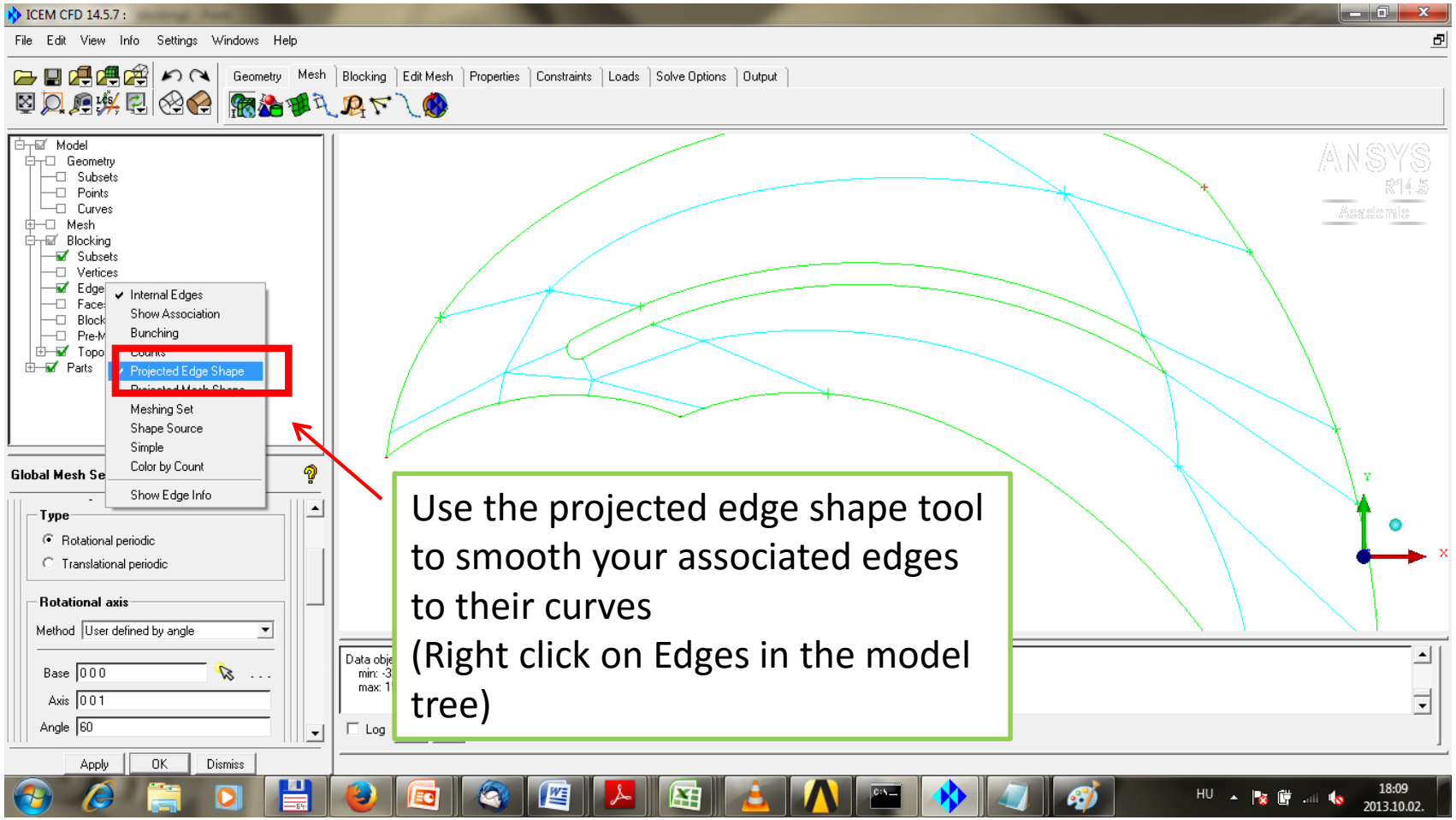
Split the block in 12 parts like in the figure on the left hand side!
At O-grid splitting select the blocks marked with blue and the edge marked with yellow!
On right hand side can be seen the blocking after the O-grid splitting.
The filled blocks are inside the blade, you can delete them.

Mesh parameters



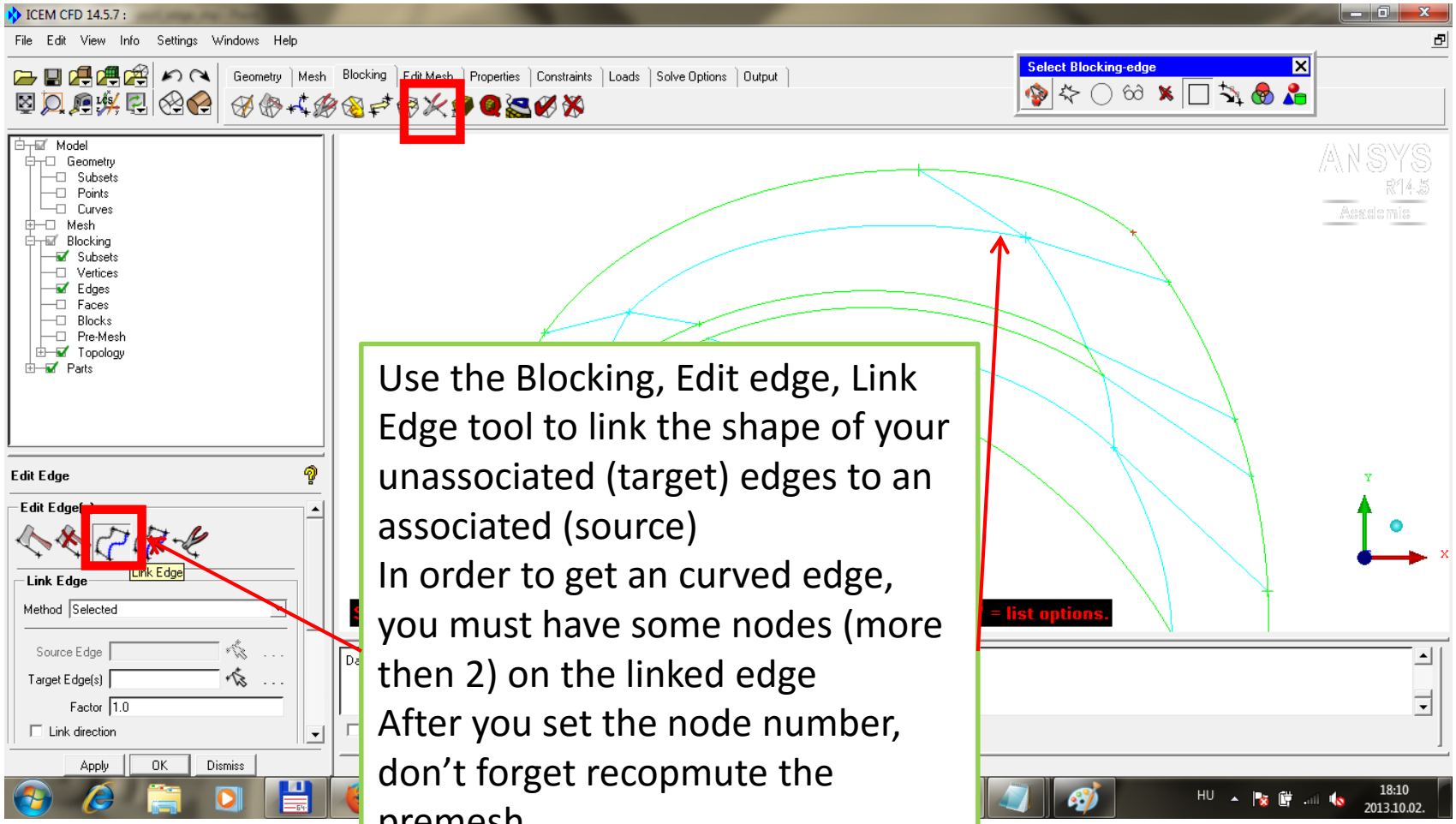
Mesh, Part mesh setup
(don't forget update your premesh:
Blocking, premesh parameters, update all;
RMB on the premesh in the display tree,
recompute)

Smoothing edge shape



Use the projected edge shape tool to smooth your associated edges to their curves
(Right click on Edges in the model tree)

Smoothing edge shape



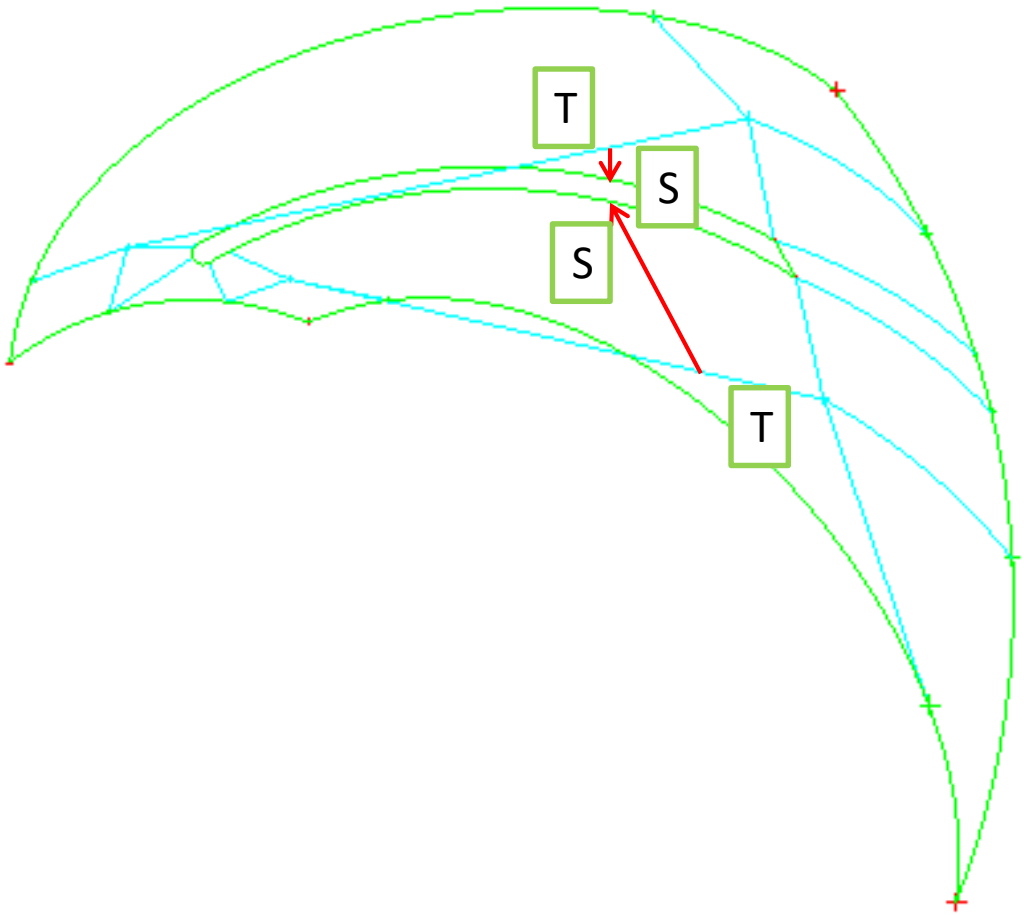
Use the Blocking, Edit edge, Link Edge tool to link the shape of your unassociated (target) edges to an associated (source)

In order to get an curved edge, you must have some nodes (more then 2) on the linked edge

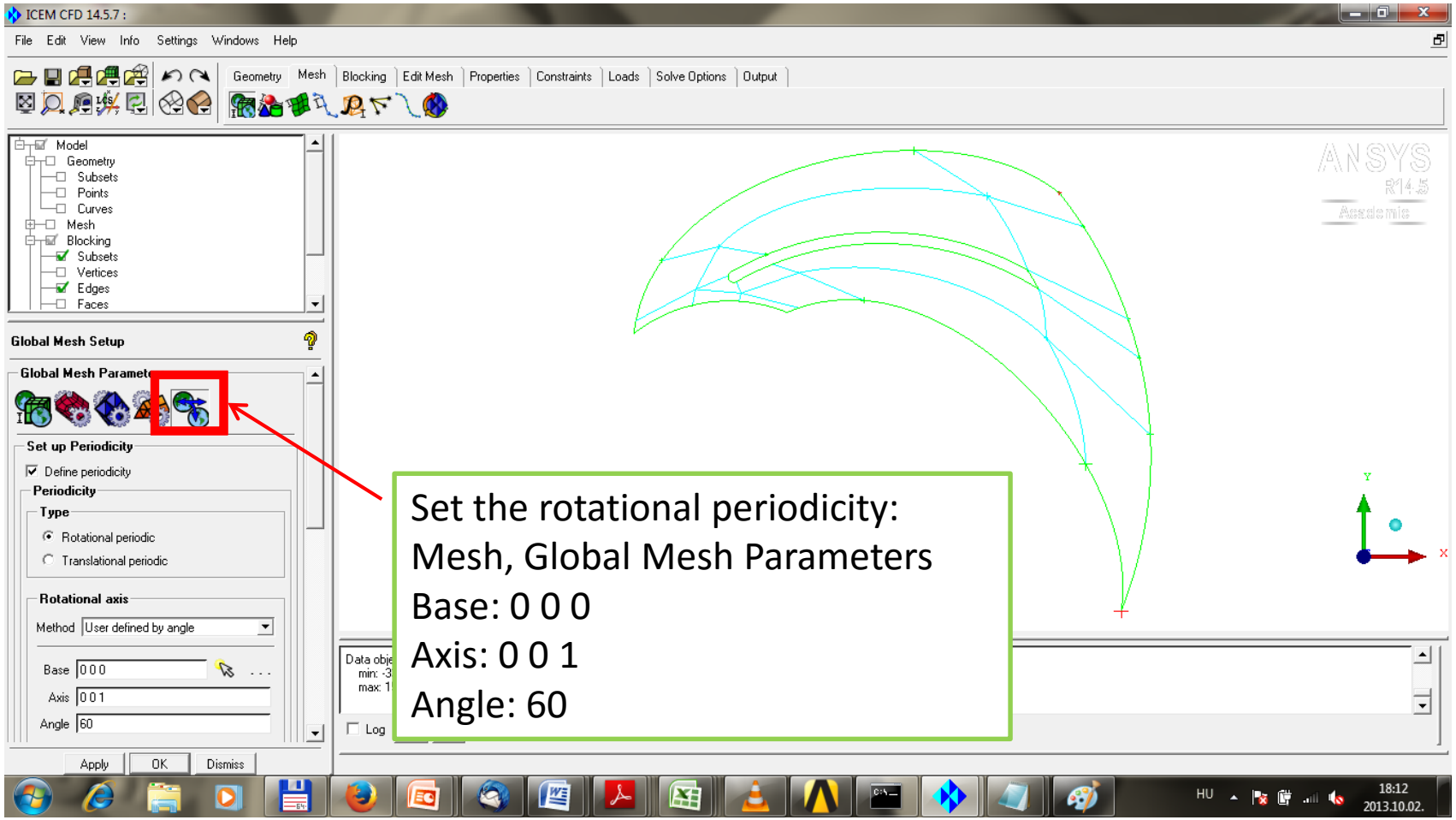
After you set the node number, don't forget recopmute the premesh

Two example can be found on the next slide

Smoothing edge shape - example

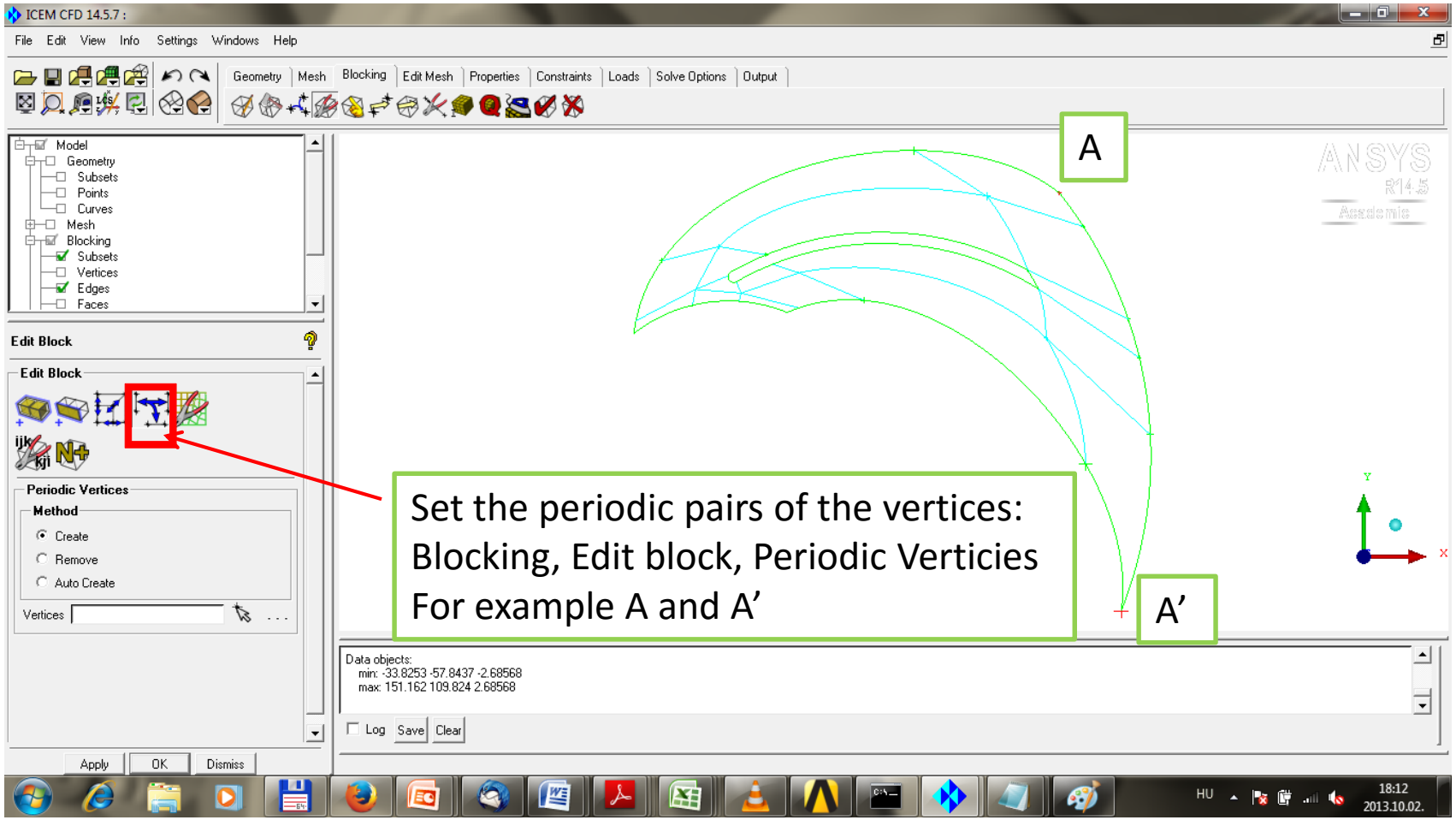


Set periodicity



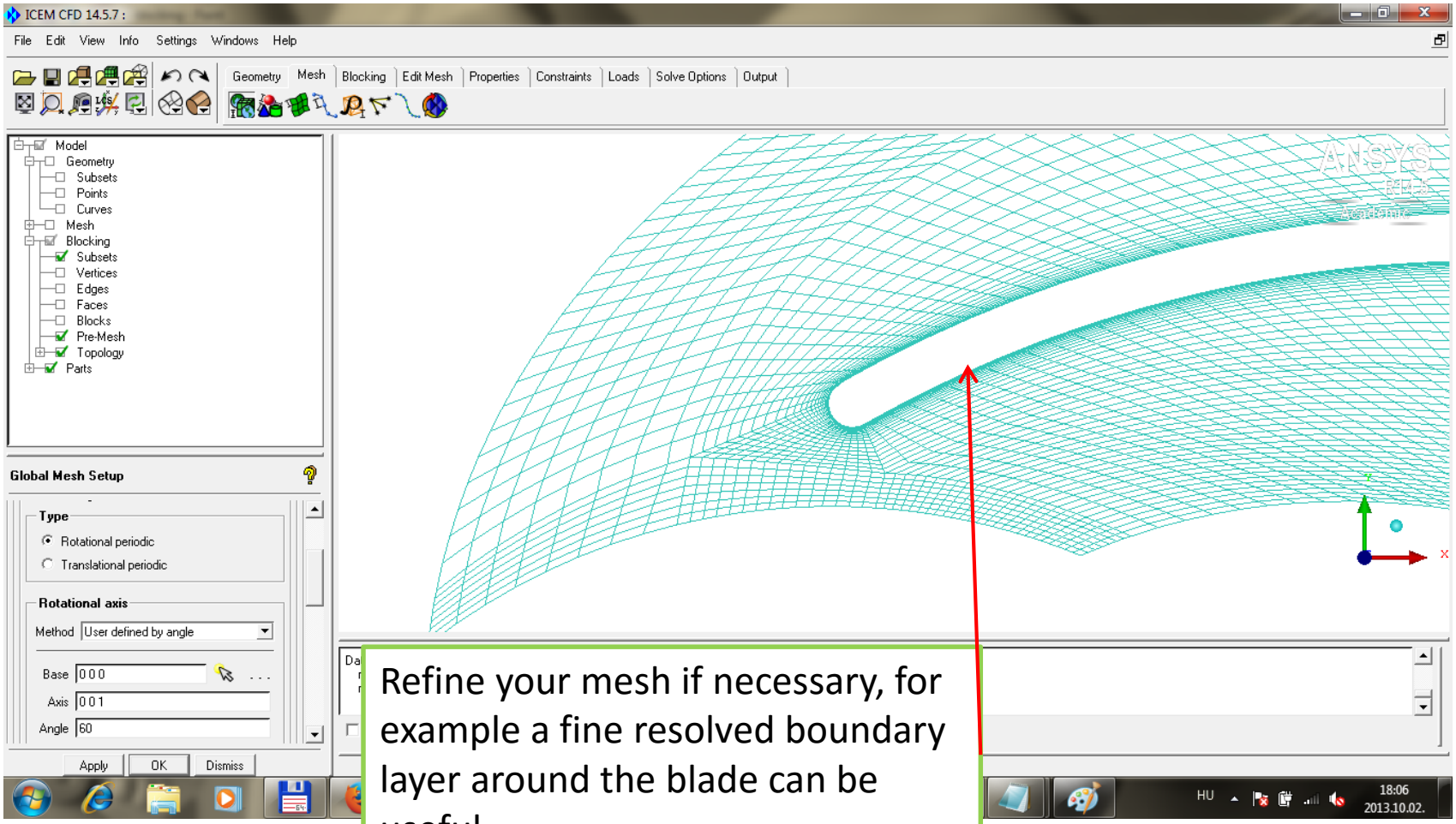
Set the rotational periodicity:
Mesh, Global Mesh Parameters
Base: 0 0 0
Axis: 0 0 1
Angle: 60

Set periodicity



Set the periodic pairs of the vertices:
Blocking, Edit block, Periodic Verticies
For example A and A'

Mesh refining



Refine your mesh if necessary, for example a fine resolved boundary layer around the blade can be useful

FLUENT

- Dimension: mm
- Material: Water
- Turbulence model: k-w SST
- Rotational moving reference frame, angular velocity: 62.6 [rad/s]
- INLET: vel.inlet, v_in=3.5 [m/s] (absolute)
  Turbulence Intensity = 10[%], d_hid=0.01[m]
- OUTLET: pressure outlet