CFD WORKSHOP

MESHING EXERCISES – GID.

EXERCISE 2.1: DRAWING

1. Close Rhinoceros and GiD.
2. Open Rhinoceros.
3. Draw a rectangle using Rhinoceros.
4. Export it in .igs format.
5. Import it using GiD.
6. Which are the ends of the line 2?
7. Delete the surface.
8. Create the surface once more.
9. Create a diagonal (line??) in the rectangle.
10. Create a segment starting from a corner that does not belong to the just created diagonal and whose end lies in the just drawn diagonal.
11. Delete both the diagonal and the line.
12. Try to delete the rest of lines and points. Can you do it?
13. Save as rectangle.gid (**take care to not use blank spaces nor weird symbols as names for your GiD projects**. Please use letters and numbers, starting with a letter).

EXERCISE 2.2: MESHING

1. Open GiD
2. Copy "RECTANGLE.igs" from the CFD_WORKSHOP folder to Z:
3. Import "RECTANGLE.igs" into GiD
4. Build an unstructured mesh in the rectangle (triangle elements, size of elements 4.2.)
5. Export it.
6. Open it with *Notepad* and check the geometrical consistency of the nodes and conectivity matrixes with what you can see in GiD.
7. Copy them to the "Compartida" folder.
8. Build an unstructured mesh (triangle elements) with at least 100 elements but no more than 120.
9. Build an unstructured mesh (triangle elements) with at least 1400 elements and no more than 1500.
10. Build a structured mesh (2 cells on the short side and 3 cells on the long one.)
11. Write down in *Notepad* the nodes and conectivities matrix.
12. Build a regular good-looking structured mesh with at least 1400 elements and no more than 1500.

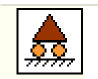
EXERCISE 2.3: MESHING SEVERAL TRAPEZOIDS.

1. Open GiD
2. Import several_trapezoids.igs, taking it from the CFD_WORKSHOP common folder
3. Create three 4-sided surfaces.
4. Create a smooth quadrilateral structured mesh of at least 200 elements on each of the surfaces.
5. Export the mesh view as a PNG file and copy it to the "Compartida" folder.
6. Install CALSEF problem type in Gid from the download page:

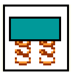
   http://www.cimne.com/calsef/default.htm

7. Open CALSEF Problem Type.
8. Force motion restriction in points 3 and 1 of the surfaces.
9. Include loads in node 7 (X force=0, Y force = -1000)
10. Use steel as the material for the computation.
11. Run the calculation.
12. Export the stresses (*tensiones*) state as a PNG file.
13. Copy it to "Compartida" folder.
14. Are stresses and deformation fields in accordance with your intuition?

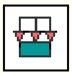
CALSEF (translation)

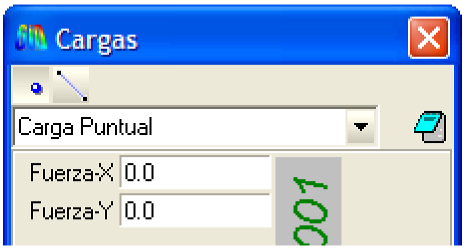
 Assign Displacement constraints.

Desplazamientos fijo: Displacement constraints.
Restricciones puntuales = point constraints.
Ejes Locales = Local Reference frame
Restricción X = X axis constraint
Desplazamiento X = X-Displacement
Ditto Y.

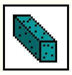
 Assign elastic constraints.

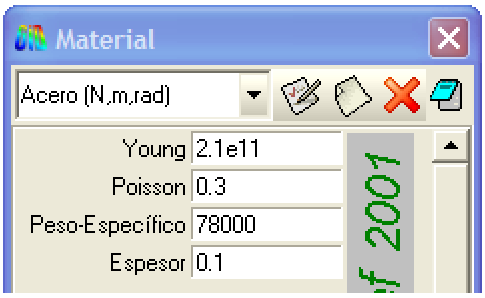
Apoyos Elást. Puntuales. elastic Point constraints.
Ejes Locales = Local Reference frame (choose a global orspecific one)
Kx and Ky = elastic constants.

 Assign loads.



Cargas = Loads.
Carga puntual = Point load.
Fuerza X= X force.
Ditto Y.

 Assign properties to materials.



Acero = steel
Hormigón = concrete
Peso-Específico = relative density
Espesor = thickness.

EXERCISE 2.4.1: MESHING

1. Open GiD
2. Draw a heptagon.
3. Decompose it in three 4-sided surfaces.
4. Create a smooth quadrilateral structured mesh of at least 200 elements on each of the surfaces.
5. Export the mesh view as a PNG file.
6. Copy it to the "Compartida" folder.

EXERCISE 2.4.2: MESHING

1. Open GiD
2. Draw a circle.
3. Divide it in four arches.
4. Create a smooth quadrilateral structured mesh of at least 200 elements.
5. Export the mesh view as a PNG file.
6. Copy it to the "Compartida" folder.

EXERCISE 2.5.1: JOIN LINES.

1. Open GiD
2. Create an heptagon-
3. Join the sides in order to create a 4-sided surface.
4. Create a smooth quadrilateral structured mesh of at least 200 elements on the surface.
5. Export the mesh view as a PNG file.
6. Copy it to the "Compartida" folder.

EXERCISE 2.5.2:

1. Open GiD
2. Import the file two_rectangles.igs
3. Create a smooth quadrilateral structured mesh of at least 600 elements on the surface between the 2 quadrilaterals.
4. Export the mesh view as a PNG file.
5. Run CALSEF Problem type using steel as the material.

6. Impose motion constraints for point 2 and 8 of the geometry
7. Impose Y force equal to -100 on node 7
8. Run CALSEF.
9. Export the Y deformation map as a PNG file
10. Copy it to the "compartida" folder.

EXERCISE 2.5.3:.

1. Open GiD
2. Import the file two_rectangles_to_trim.igs
3. Create a smooth quadrilateral structured mesh of at least 400 elements.
4. Export the mesh view as a PNG file.
5. Copy it to the "Compartida" folder.

EXERCISE 2.5.4:

1. Open GiD
2. Import the file two_circles.igs
3. Create a smooth quadrilateral structured mesh of at least 500 elements on the surface between the 2 circles.
4. Export the mesh view as a PNG file.
5. Copy it to the "Compartida" folder.

EXERCISE 2.5.5:

1. Open GiD
2. Import the file triangle_rectangle.igs
3. Create a smooth quadrilateral structured mesh of at least 500 elements on the surface between the 2 polygons.
4. Export the mesh view as a PNG file.
5. Copy it to the "Compartida" folder.

EXERCISE 2.5.6:.

1. Open GiD
2. Import the file "rectangle_circle_to_trim.igs"
3. Create a smooth quadrilateral structured mesh of at least 500 elements.
4. Export the mesh view as a PNG file.

5. Copy it to the "Compartida" folder.

EXERCISE 2.5.7:

1. Open GiD
2. Import the file "rectangle_triangle.igs"
3. Create a smooth quadrilateral structured mesh of at least 500 elements on the surface between the 2 polygons.
4. Export the mesh view as a PNG file.
5. Copy it to the "Compartida" folder.

EXERCISE 2.5.8:

1. Open GiD
2. Import the file "circle_triangle.igs"
3. Create a smooth quadrilateral structured mesh of at least 700 elements on the surface between the 2 polygons.
4. Export the mesh view as a PNG file.
5. Copy it to the "Compartida" folder.

EXERCISE 2.5.9:

1. Open GiD
2. Import the file "triangle_circle_rectangle.igs"
3. Create a smooth quadrilateral structured mesh of at least 1000 elements on the surface between the big polygon and the 2 small ones.
4. Export the mesh view as a PNG file.
5. Copy it to the "Compartida" folder.

EXERCISE 3.1: ADAPTATIVE MESHING

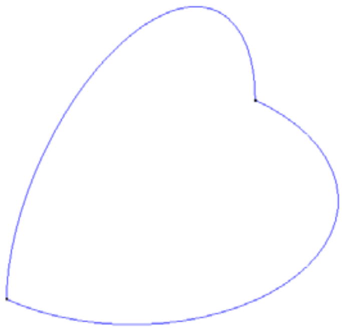
1. Open GiD
2. Import the file "trapezoid.igs" from the course folder.
3. Create a 4-sided surface.
4. Divide it in two parts, one small and one much bigger, using the bigger parts sides of the trapezoid.
5. Create a smooth quadrilateral structured mesh of at least 300 elements on the small surface.
6. Create a structured mesh of no more than 100 elements on the adjacent surface, keeping a progression in the cell sizes.
7. Save the file.
8. Export the mesh view as a PNG file.
9. Copy it to the "Compartida" folder.

EXERCISE 3.2: ADAPTATIVE MESHING

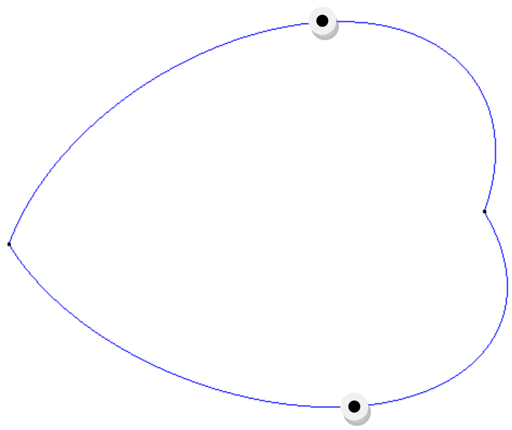
1. Open GiD
2. Draw an heptagon.
3. Decompose it into three 4-sided surfaces.
4. Create a smooth quadrilateral structured mesh of at least 500 elements on the triangular surface.
5. Create a structured mesh of no more than 200 elements on the adjacent surface, keeping a progression in the cell sizes.
6. Create a structured mesh of no more than 200 elements on the last surface, keeping a progression in the cell sizes.
7. Export the mesh view as a PNG file.
8. Copy it to the "Compartida" folder.

EXERCISE 6.1: COURSE LOGO

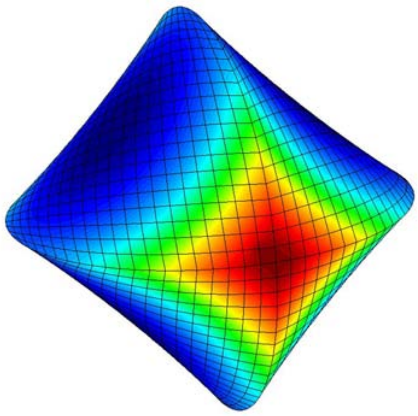
1. Open GiD
2. Create a sphere
3. Remove the object, surfaces and keep the lines and points.
4. Remove the lines to obtain this:



5. Divide the arcs to obtain a 4 sided surface.

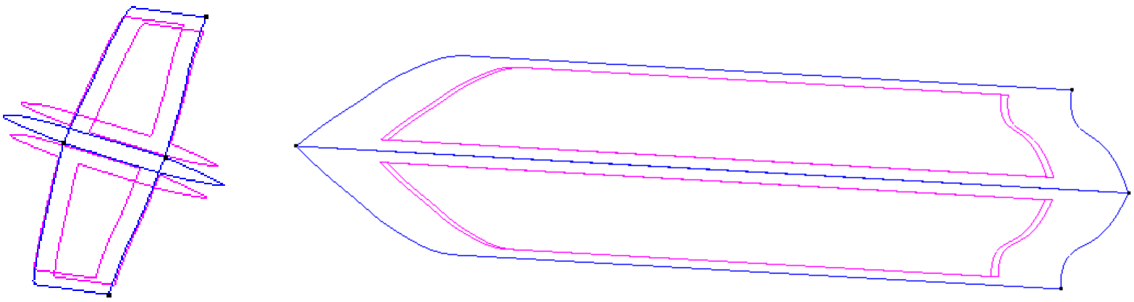


6. Create the surface.
7. Check the normals orientation.
8. Create a structured quadrilateral mesh.
9. Use mirroring to build the course logo surface.
10. Run Hess3D to obtain the logo.
11. Export the graph to PNG and copy it to the "Compartida" folder



EXERCISE 6.2: MY FIRST SHIP

1. Open GiD
2. Import "my_first_ship.igs"
3. Clean the geometry by removing useless lines and points.
4. Mesh it taking into account that a larger density of panels is required both at the front and back parts.
5. Perform the necessary mirroring to obtain a closed body (Utilities, Copy, Mirror).



6. Check that it is oriented facing an incoming (-1,0) flow
7. Mesh it with a structured quadrilateral mesh of at least 1000 elements.
8. Run Hess3D
9. Export the graph to a PNG file and copy it to the "Compartida" folder.

EXERCISE 6.3: AIRFOIL

1. Open GiD
2. Import "Airfoil.igs"
3. Rotate it so that the leading edge faces the incoming (-1,0) flow (Utilities, Move, Rotation).
4. Mesh it with a structured mesh of quadrilateral elements of at least 500 elements. Feel free to delete and create new flat surfaces in order to define the mesh.
5. Export a graph of the surfaces decomposition as a PNG to the "Compartida" folder.
6. Run Hess3D
7. Export the graph to a PNG file and copy it to the "Compartida" folder

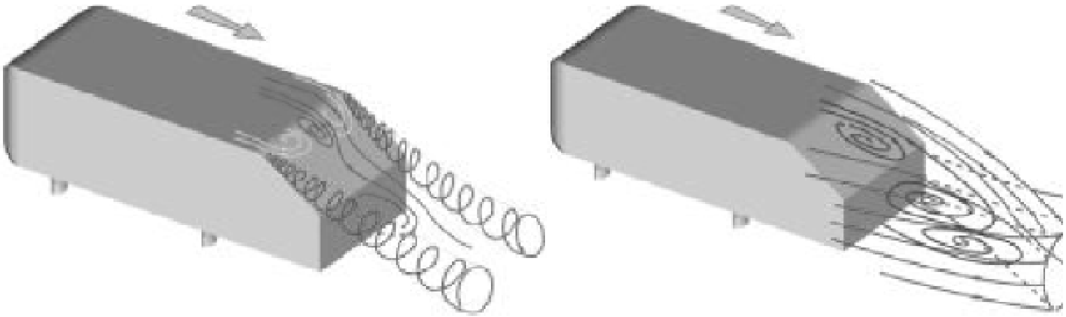
EXERCISE 6.4: AIRFOIL+CUBE

1. Open GiD
2. Import "Airfoil_cube.igs"
3. Trim both surfaces using Geometry – Edit - Intersection-Surface/Surface.
4. Rotate it to face it with the leading edge of the incoming (-1,0) flow
5. Mesh it with a structured quadrilateral mesh of at least 1000 elements.

6. Run Hess3D
7. Export the graph to a PNG file and copy it to the “Compartida” folder

EXERCISE 6.5: AHMED BODY.

1. Open GiD
2. Import “ahmed_body.igs”
3. Rotate it to face it with the leading edge of the incoming (-1,0) flow



4. Mesh it with a structured quadrilateral mesh of at least 2000 elements.
5. Run Hess3D.
6. Export the graph to a PNG file and copy it to the “Compartida” folder

EXERCISE 7.1: Optimize the bow shape.

1. Open Rhinoceros.
2. Open “my_first_ship.igs”
3. Clean the geometry by removing useless lines and points.
4. Check the structure of the surface patches.
5. Modify the forward patches to create a bulbous bow.
6. Export the surface.
7. Mesh it and run it with a similar density to the original “my_first_ship.igs” file.
8. Compare longitudinal wave cuts with EXCEL, MATLAB or GNUPLOT.
9. Export the graphs of the wave system and of the wave cuts and share them by uploading them to the “COMPARTIDA” folder.

EXERCISE 7.2: Merchant ship.

1. Open GiD.
2. Open “S_60_3.gid”
3. Build the free-surface polygon and surface. Check the normals.
4. Set the speed to 10 m/s
5. Mesh the free surface.
6. Mesh the hull (the mesh is already defined)
7. Run “ETSIN_CFD”.
8. Analyse the longitudinal wave cuts and other outputs.
9. Refine the mesh and check the convergence.

EXERCISE 7.3: ILC30 Sailing boat.

14. Open GiD.
15. Open “cp_0561.gid”
16. The yacht’s main dimensions are:

Draft	0.352
Length	8.04
Beam	2.148

17. Using the icon [icon] we can activate the layers corresponding to the hull and the free surface.
18. Set the speed to 5 m/s
19. Mesh the free surface.
20. Mesh the hull.
21. Run “ETSIN_CFD”.
22. Analyse the longitudinal wave cuts and other outputs.
23. Refine the mesh and check the convergence.

EXERCISE 7.4: AMERICA’S CUP (IACC Class sailing yacht).

1. Follow the tutorial to run the IACC Class ship.