

Ex 4.3

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The solution is in the folder **ex4-3**, where there is a **README.md** file with instructions to run it. We made the different meshes in Gmsh.app for a range of meshes running the command on the terminal **gmsh cube.geo -3 -clscale 0.5 -o cube.msh**, this example if for mesh size of 0.5 for the dimension 3. and we got the meshes as 1 and 2.

For $N = 1$ we got the following table :

mesh size	run-t Sparse	run-t Dense	diference time
5.00e-01	0.00	5.95e-06	0.00
4.00e-01	0.00	4.96e-06	0.00
3.00e-01	0.00	8.92e-06	0.00
2.00e-01	0.00	8.33e-06	0.00

for the case of 2 dimentionns

mesh size	run-t Sparse	run-t Dense	diference time
1.00e+00	0.00	6.19e-05	0.00
5.00e-01	0.00	7.53e-04	0.00
3.00e-01	0.00	6.71e-03	0.01
2.00e-01	0.00	4.64e-02	0.04

and for 3 dimentionns

mesh size	run-t Sparse	run-t Dense	diference time
1.00e+00	0.00	9.37e-04	0.00
5.00e-01	0.01	7.49e-02	0.07
3.00e-01	0.05	2.96e+00	2.91
2.00e-01	0.33	7.55e+01	75.18

As we can observe the time grows too much in the mesh size from 0.3 to 0.2 in the order of minutes, so we can observe the inefficiency of dense matrix.

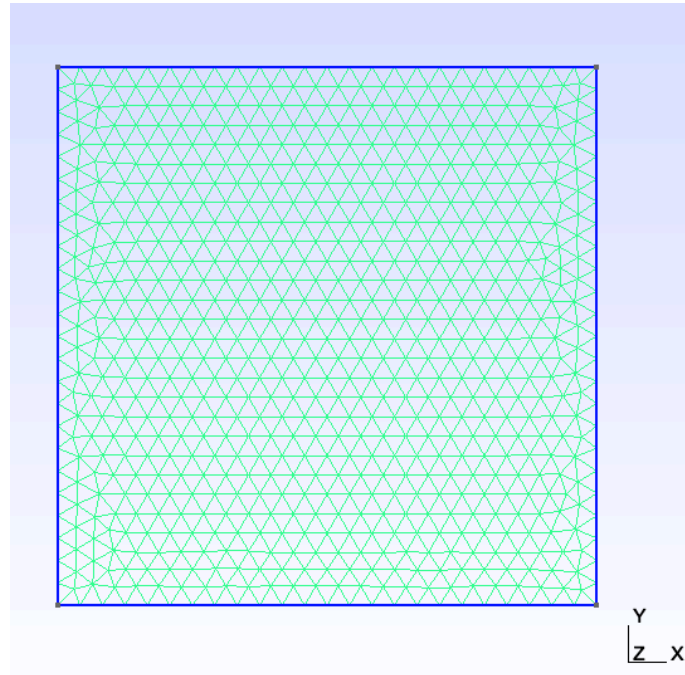


Figure 1: the mesh for a size of 0.2

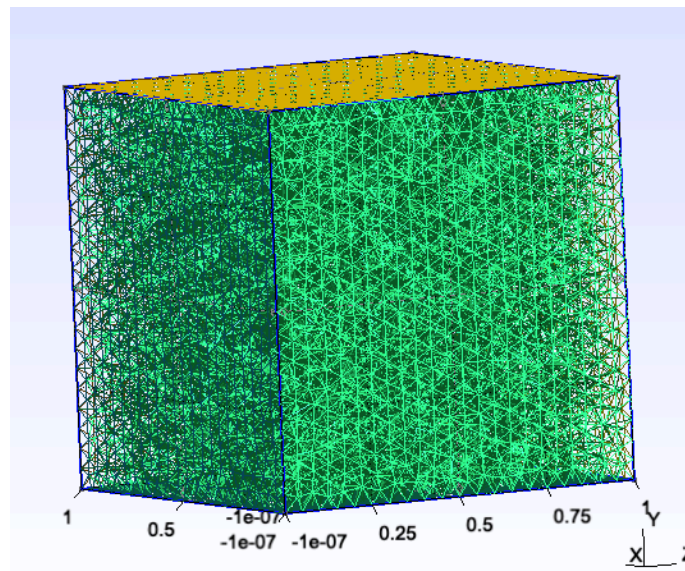


Figure 2: the mesh for a size of 0.2

note: for smaller meshes than 0.2 the kernel restart several times, so we didn't include a finer mesh.