Lab 04 - C++ Templates and Dimension Independence (step-4)

Numerical Solution of PDEs Using the Finite Element Method

MHPC P2.13_seed

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1. See documentation of step-4 at https://www.dealii.org/8.5.0/doxygen/deal.II/step_4.html
2. Write a member function `void mesh_info()` that prints the following information about the triangulation to the screen: 1) number of active cells, 2) number of active/used vertices, lines, quads, hexs (only if appropriate for the dimension!).
3. Use `VectorTools::compute_mean_value` (see step-3) and verify the convergence order of the mean in 2d and 3d.
4. Go back to step-1 and visualize the surface of the Torus by creating a `Triangulation<2,3>` (2=dimension of the cells, 3=dimension of the space) using `GridGenerator::torus` if you haven't done so.
5. Try to use the function GridTools::rotate in make_grid() to rotate the mesh by 45 degrees (only in 2d!). Note that the function doesn't exist in 3d (hint: function specialization).
6. Change the mesh to an L-shape, only apply boundary values to the faces adjacent to the re-entrant corner (see `set_boundary_indicator()` in the step-3 description), change the boundary values to be $1 + \|x\|_2$ and the right-hand side to be 1. Finally, visualize your solutions in ParaView in 2d and 3d.