Linear Elasticity Tutorial 3D bar problem clamped at one end wile being pulled at the other end (Dirichlet-Neumann case)

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Abstract

This document details a single tutorials of 'linear elasticity' module of PSD in a more verbos manner.

In this section we present a 3D PSD simulation of a clamped bar which his being loaded in vertical direction at the non-clamped end. This simulation is like the one presented in previous tutorials, however in 3D. The material properties are same as before, and at the non-clamped end traction $t_y = -10^9$ units. The 3D bar is $1 \times 1 \times 5$ m^3.

Here is how PSD simulation of this case can be performed.

Step 1: Preprocessing

For "PSD setup" go to any folder, launch the terminal there and run the following command.

```
PSD_PreProcess -problem linear-elasticity -dimension 3 -dirichletconditions 1 -tractionconditions 1 -postprocess u
```

% the comandline flag -dirichletconditions 1 notifies to PSD that there is one Dirichlet border —the clamped end of the bar— in this simulation; -dimension 3 means the simulation is 3D. And the flag -tractionconditions 1 notifies to PSD that there is one traction border —the right end of the bar— in this simulation. To provide Dirichlet conditions of the clamped end ($u_x = 0, u_y = 0, u_z = 0$) in ControlParameters.edp set Dbc0On 1, Dbc0Ux 0., Dbc0Uy 0., and Dbc0Uz 0., where 1 being the surface mesh label of the clamped end. To add the traction boundary condition set Tbc0On 2 and Tbc0Ty -1.e9, here the mesh label number of the right end is 2. For this end $\mathbf{t} = [t_x, t_y, t_z] = [0., 10^9, 0.]$, hence in ControlParameters.edp we only use Tbc0Ty -1.e9.

Step 2: Solving

Let us now use 4 cores to solve this problem. To do so enter the following command:

```
PSD_Solve -np 4 Main.edp
```

% Notice, that this is the exact same command used in solving the previous bar problems from other sections.

Step 3: Postprocessing

Launch ParaView and have a look at the .pvd file in the PSD/Solver/VTUs_DATE_TIME folder.

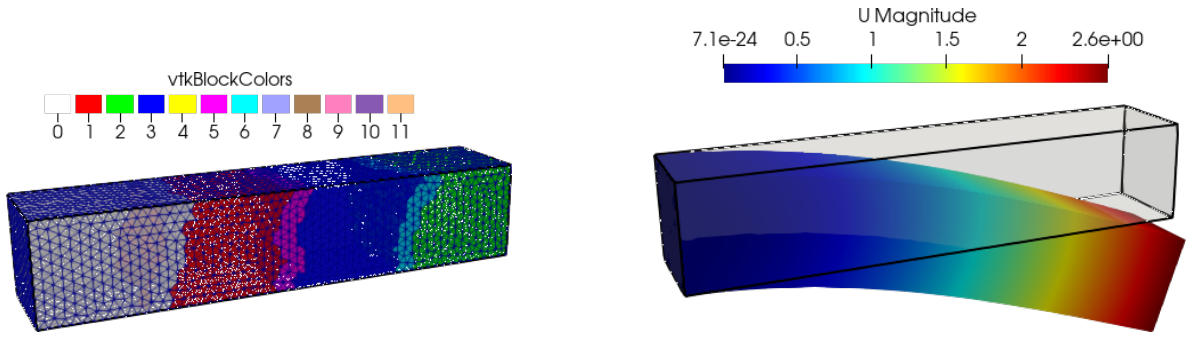

Figure 1: 3D bar results. Partitioned mesh (left) and 0.5X warped displacement field (right).

In~fig. 1 there are four subdomais in the partitioned mesh since four cores were used.