FEM solvers in ANSYS

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Direct v. iterative solvers comparison

- Available solvers in ANSYS:
  - Sparse (Direct solver)
  - Preconditioned Conjugate Gradient - PCG(Iterative)
  - Jacobi Conjugate Gradient - JCG (Iterative)
  - Incomplete Cholesky Conjugate Gradient - ICCG (Iterative)
  - Quasi-Minimal Residual - QMR (Iterative)
- The selection of a solver can affect the speed and accuracy of a solution
- Solver needs to be specified at first load step
- In iterative solvers the tolerance can be modified at various time steps
- For distributed memory computations only SPARSE and PCG (and partly JCG) solvers are available in ANSYS
- Refer to ANSYS Help for further info (EQSLV.mhtml and Selecting a Solver.mhtml)

Direct v. iterative solvers comparison

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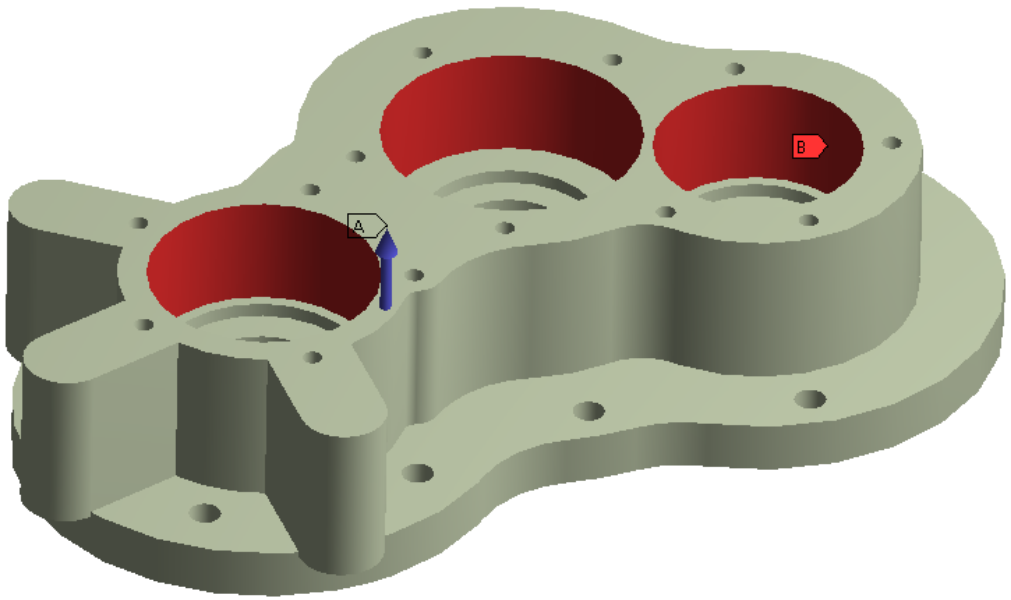
Case 1 – Thermal analysis

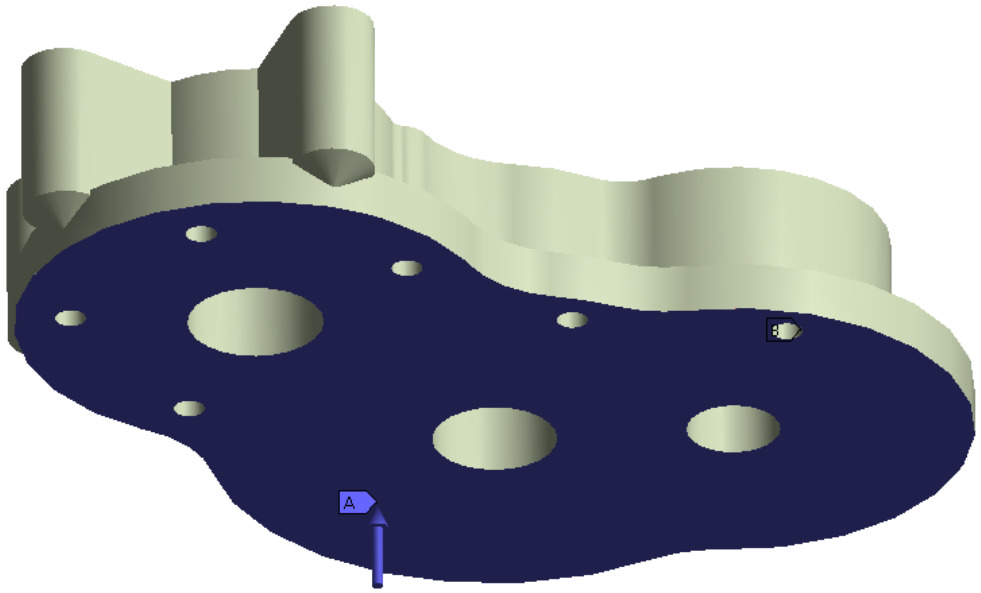
A: Carter - Direct
Steady-State Thermal
Time: 1. s
24. 06. 2021 15:51

A Heat Flux: 0.5 W/mm²
B Temperature: 19.85 °C

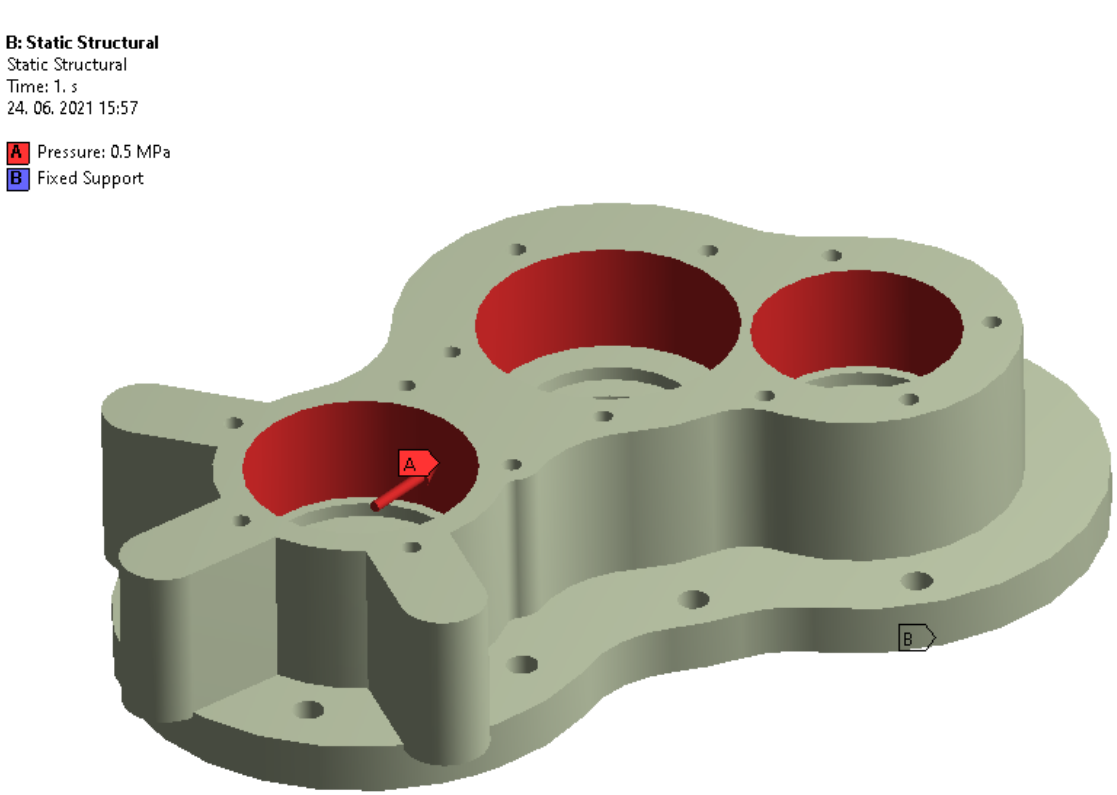


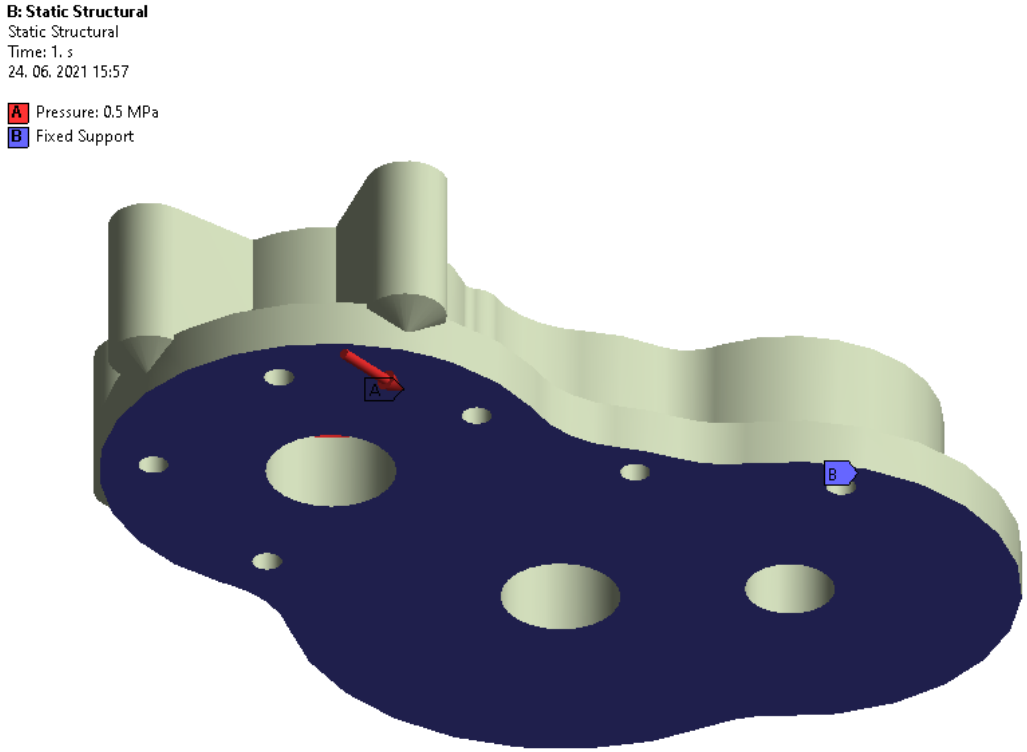
A: Carter - Direct
Steady-State Thermal
Time: 1. s
24. 06. 2021 15:52

A Heat Flux: 0.5 W/mm²
B Temperature: 19.85 °C



Case 2 – Structural analysis

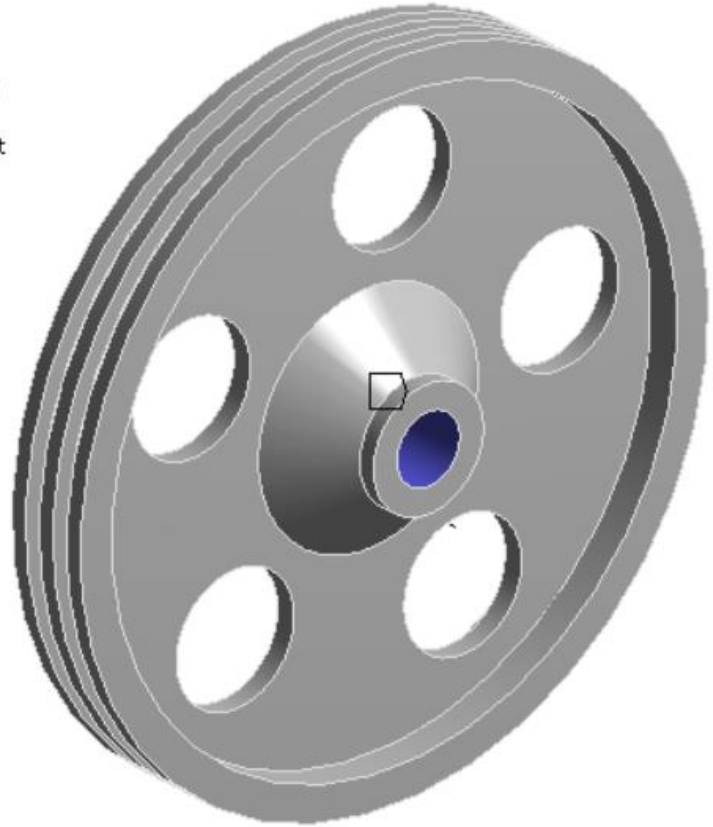




Case 3 – Modal analysis

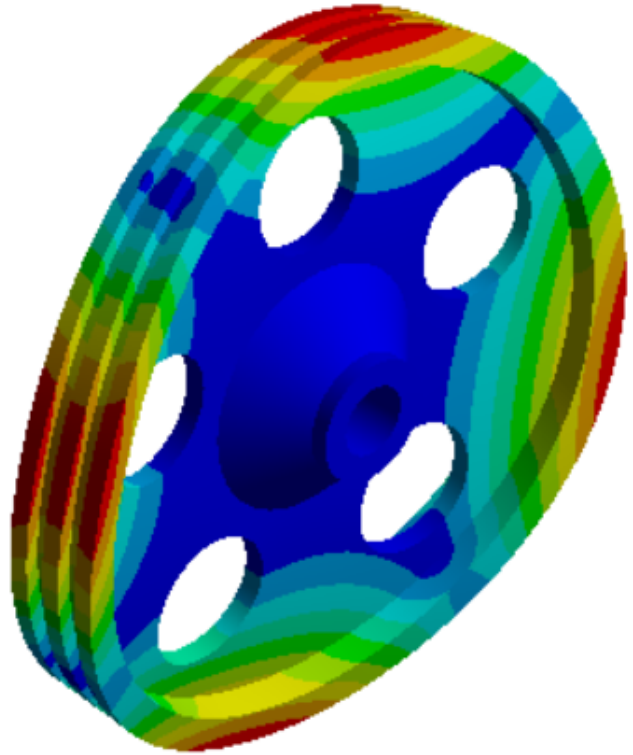
C: Modal
Modal
Frequency: N/A
27. 06. 2021 18:26

Fixed Support



C: Modal
Total Deformation
Type: Total Deformation
Frequency: 535.9 Hz
Unit: mm
Deformation Scale Factor: 1.0 (True Scale)
27. 06. 2021 18:28

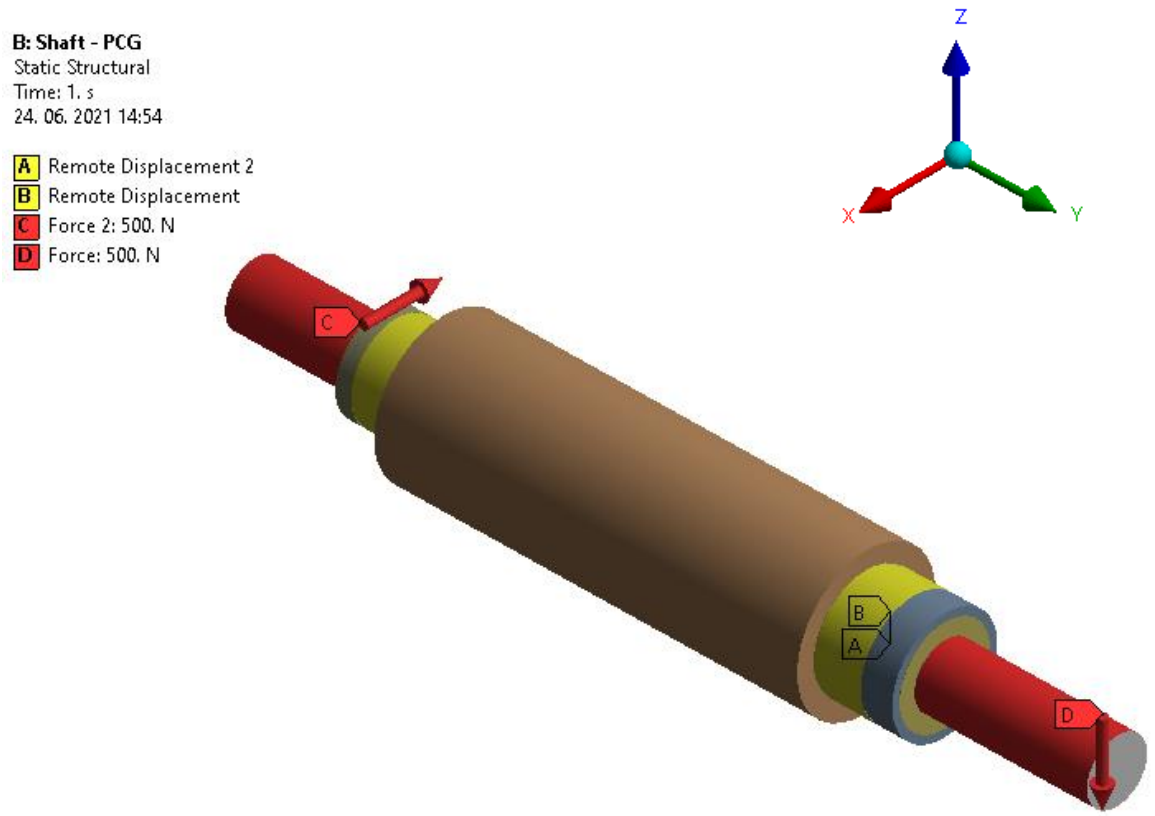
17.674 Max
15.71
13.747
11.783
9.819
7.8552
5.8914
3.9276
1.9638
0 Min



Direct v. iterative solvers comparison

Individual work case

- Apply BCs and loads as shown
- One bearing seat (yellow) fully fixed, the other free in the y-direction
  - Use Remote Displacement constraint with Deformable behaviour
- Compare results using direct, PCG, JCG and ICCG solvers with 4 CPU cores
  - ➢ Perform computation via terminal using input file
- Compute with 1, 2, 4, 8 and 16 cores and draw a problem scalability graph



Thank you for your attention!

http://sctrain.eu/

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