Answer Sheet Introduction to FEM

Practical 2, Group A (Gantry)

|  |  |
| --- | --- |
| **Student name** | **Student number** |
|  |  |

**Before you start, read the practical preparation manual carefully! Follow the steps of the instruction manual closely when working with ANSYS APDL.**

**1.** Determine the displacements and rotations at the nodes.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **node** | **u [mm]** | **v [mm]** | **w [mm]** | **ϕx [rad]** | **ϕy [rad]** | **ϕz [rad]** |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |
| 11 |  |  |  |  |  |  |

**2.** Determine the reaction forces and reaction moments at the supports.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **node** | **Fx [N]** | **Fy [N]** | **Fz [N]** | **Mx [Nm]** | **My [Nm]** | **Mz [Nm]** |
| 1 |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |

**3a.** Check whether the sum of forces equals zero. Display the entire equation.

|  |  |  |
| --- | --- | --- |
| **sum** | **equation** | **[kN]** |
|  |  |  |
|  |  |  |
|  |  |  |

**3b.** Check whether the sum of moments equals zero. Display the entire equation.

|  |  |  |
| --- | --- | --- |
| **sum** | **equation** | **[kNm]** |
|  |  |  |
|  |  |  |
|  |  |  |

**4.** Check the deflections and rotations of element number 11. The elongation is in x-direction, the deflection in y-direction and the rotation around the z-axis. Use the cantilever beam equations (vergeet-mij-nietjes) to calculate an analytic estimate of the results provided by Ansys. Use the forces and moments from Ansys (List results→All available force items) for these calculations. Hint: view node 11 as constraint. Look in the practicum preparation (eq. (1.1) and (1.2)) and instructions for more information and pay close attention the directionality of properties. Compare the analytical solutions with the deflection and rotation of the beam (nodes) calculated by ANSYS.

* Normal force : ………… kN
* Transverse force : ………… kN
* Moment : …………. kNm

|  |  |  |  |
| --- | --- | --- | --- |
|  | **elongation [mm]** | **rotation [rad]** | **deflection [mm]** |
| Analytical calculations |  |  |  |
| Using ANSYS |  |  |  |

**5a.** What is the largest stress in the construction?

**5b.** In which beam is this stress found?