Question 1

Versió 1 (la més recent)

Pregunta 1

Resposta desada

Puntuat sobre 10,00

The sketch in the Figure is part of a scaffold made of cylindrical bars: 12 bars of length $L_1 = 3000.0$ mm, 2 bars of length $L_2 = L_1\sqrt{2}$ mm, and 1 bar of length $L_3 = L_1\sqrt{3}$ mm, *all* them having $\phi = 35.0$ mm transversal section diameter (**not** radius!), and $Y = 212.0$ GPa Young modulus.

On the one hand we know that points $A, \ldots, F$ are clamped so they can't move in any of the three spatial directions and, on the other hand, that at each of the junctions G and H there is acting a force of modulus $||\vec{F}|| = 2000.0$ kN that are applied in the direction of bar $\overline{BG}$, pointing outwards the structure.

As in practice 2.4, use the FEM to find the displacements of the structure's nodes, the reaction forces, and the bars' *final* length, i.e., the bars' length when the above decribed forces are applied at the specified nodes.

Important remark: set up the meshing taking the axes' position as shown in the Figure, i.e., with point B placed at the origin, and the bars $\overline{AB}$, $\overline{BD}$, and $\overline{BF}$ on axes x, y, and z respectively.

Then, answer the questions below.

(a) (3 points) The reduced system's matrix's trace's value is (in kN/mm),

- ○ Leave it empty (no penalty)
- ○ 5.5712e+02
- ○ 5.8502e+02
- ○ 5.3207e+02
- ○ 5.4539e+02
- ◉ 5.4334e+02

Hint. The entry $K_{2,2}$ of the global stiffness matrix is $K_{2,2} = 9.2027$e+01 kN/mm.

(b) (3 points) If Y_j denote, the y-component of the reaction force at the (global) node j, with j ranging from 1 to the number of global nodes, N; then the absolute value $\max_{j=1,\ldots,N} |Y_j|$ (in kN) is

- ○ 3.2563e+03
- ○ 3.1758e+03
- ◉ 2.7877e+03
- ○ Leave it empty (no penalty)
- ○ 2.9454e+03
- ○ 2.7334e+03

Hint. The x-component of the reaction force of node 1 is $X_1 = 4.7829$e+02 kN.

(c) (4 points) when forces are upon, the maximum length of the deformed bars (in mm) is

- ○ Leave it empty (no penalty)
- ◉ 5.3007e+03
- ○ 5.7809e+03
- ○ 5.1811e+03
- ○ 5.4598e+03
- ○ 5.1974e+03

Hint. $\overline{CG}$ bar's *final* length is $\left|\overline{CG}\right| = 2.9965$e+03 mm.

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