Matrice des masses M :

$$M := \begin{bmatrix} 4.2830 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 4.2830 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.12700 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 5 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 5 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.10000 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 122.35 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 122.35 \end{bmatrix}$$

Matrice des raideurs K:

$$K := \begin{bmatrix} 2.0000\,10^{10} & 0. & 0. & -1.0000\,10^{10} & 0. & 1.9151\,10^{9} & 0. & 0. \\ 0. & 2.0000\,10^{10} & 0. & 0. & -1.0000\,10^{10} & 1.6070\,10^{9} & 0. & 0. \\ 0. & 0. & 1.5132\,10^{7} & -2.6915\,10^{8} & -5.6443\,10^{7} & 6.0615\,10^{7} & 0. & 0. \\ -1.0000\,10^{10} & 0. & -2.6915\,10^{8} & 2.0000\,10^{10} & 0. & 0. & -1.0000\,10^{10} & 0. \\ 0. & -1.0000\,10^{10} & -5.6443\,10^{7} & 0. & 2.0000\,10^{10} & 0. & 0. & -1.0000\,10^{10} \\ 1.9151\,10^{9} & 1.6070\,10^{9} & 6.0615\,10^{7} & 0. & 0. & 1.2500\,10^{9} & -1.9151\,10^{9} & -1.6070\,10^{9} \\ 0. & 0. & 0. & -1.0000\,10^{10} & 0. & -1.9151\,10^{9} & 1.0000\,10^{10} & 0. \\ 0. & 0. & 0. & 0. & -1.0000\,10^{10} & -1.6070\,10^{9} & 0. & 1.0000\,10^{10} \end{bmatrix}$$

Matrice des $M^{-1}K$:

```
> DD := simplify(MatrixMatrixMultiply(MatrixInverse(M),K));
```

$$DD := \begin{bmatrix} 4.6696\,10^{9} & 0. & 0. & -2.3348\,10^{9} & 0. & 4.4714\,10^{8} & 0. & 0. \\ 0. & 4.6696\,10^{9} & 0. & 0. & -2.3348\,10^{9} & 3.7520\,10^{8} & 0. & 0. \\ 0. & 0. & 1.1915\,10^{8} & -2.1193\,10^{9} & -4.4443\,10^{8} & 4.7728\,10^{8} & 0. & 0. \\ -2.0000\,10^{9} & 0. & -5.3830\,10^{7} & 4.0000\,10^{9} & 0. & 0. & -2.0000\,10^{9} & 0. \\ 0. & -2.0000\,10^{9} & -1.1289\,10^{7} & 0. & 4.0000\,10^{9} & 0. & 0. & -2.0000\,10^{9} \\ 1.9151\,10^{10} & 1.6070\,10^{10} & 6.0615\,10^{8} & 0. & 0. & 1.2500\,10^{10} & -1.9151\,10^{10} & -1.6070\,10^{10} \\ 0. & 0. & 0. & -8.1733\,10^{7} & 0. & -1.5653\,10^{7} & 8.1733\,10^{7} & 0. \\ 0. & 0. & 0. & 0. & -8.1733\,10^{7} & -1.3134\,10^{7} & 0. & 8.1733\,10^{7} \end{bmatrix}$$

Calcul des pulsations propres à partir de $\left|K - \omega^2 M\right| = 0$:

```
> solve(Determinant(K-omega^2*M)=0,omega);
```

$$1.5550, \ 1.4209 + 0.63219\,I, \ 1.0404 + 1.1545\,I, \ 0.48105 + 1.4788\,I,$$
$$-0.16084 + 1.5453\,I, \ -0.77713 + 1.3469\,I, \ -1.2580 + 0.91497\,I,$$
$$-1.5216 + 0.32381\,I, \ -239.76, \ -1.5216 - 0.32381\,I, \ -1.2580$$
$$- 0.91497\,I, \ -0.77713 - 1.3469\,I, \ -0.16084 - 1.5453\,I, \ 0.48105$$
$$- 1.4788\,I, \ 1.0404 - 1.1545\,I, \ 1.4209 - 0.63219\,I$$

Calcul des pulsations propres à partir de $\left|M^{-1}K - \omega^2 I\right| = 0$:

```
> solve(Determinant(DD-omega^2*IdentityMatrix(8))=0,omega);
```

$$1.4996, \ 1.3692 + 0.60982\,I, \ 1.0033 + 1.1141\,I, \ 0.46303 + 1.4244\,I,$$
$$-0.15653 + 1.4900\,I, \ -0.74886 + 1.2987\,I, \ -1.2124 + 0.88172\,I,$$
$$-1.4669 + 0.31204\,I, \ -500.98, \ -1.4669 - 0.31204\,I, \ -1.2124$$
$$- 0.88172\,I, \ -0.74886 - 1.2987\,I, \ -0.15653 - 1.4900\,I, \ 0.46303$$
$$- 1.4244\,I, \ 1.0033 - 1.1141\,I, \ 1.3692 - 0.60982\,I$$

Calcul des pulsations propres des valeurs propres de $M^{-1}K$

```
> simplify(Eigenvalues(DD));
> simplify(map(x->sqrt(x),%));
```

$$\begin{bmatrix} 1.4170\,10^{10} \\ 6.5340\,10^{9} \\ 5.6117\,10^{9} \\ 2.2000\,10^{9} \\ 1.5628\,10^{9} \\ 4.3787\,10^{7} \\ 30291. \\ -215.56 \end{bmatrix} \qquad \begin{bmatrix} 1.1904\,10^{5} \\ 80833. \\ 74911. \\ 46904. \\ 39532. \\ 6617.2 \\ 174.04 \\ 14.682\,I \end{bmatrix}$$