

## N9PLTE

**Calculation of the characteristic equation of the 4 by 4 matrix of the boundary value problem**

$$\begin{bmatrix} 1 & -1 & 0 & 0 \\ k_2 & 0 & k_1 & 0 \\ 0 & \cos(k_1 \cdot d) & -\sin(k_1 \cdot d) & -(1) \\ 0 & -k_1 \cdot \sin(k_1 \cdot d) & -k_1 \cdot \cos(k_1 \cdot d) & k_3 \end{bmatrix}$$

the result of the development of the determinant is

$$\left( -\cos(k_1 \cdot d) \cdot k_1 \cdot k_3 + k_1^2 \cdot \sin(k_1 \cdot d) - k_2 \cdot \sin(k_1 \cdot d) \cdot k_3 - k_2 \cdot k_1 \cdot \cos(k_1 \cdot d) \right)$$

without computer

$$(\cos(k_1 \cdot d) \cdot (k_1 \cdot k_3 + k_1 \cdot k_2)) = \blacksquare$$

$$\sin(k_1 \cdot d) \cdot (k_1^2 - k_2 \cdot k_3) = [(\cos(k_1 \cdot d) \cdot (k_1 \cdot k_3 + k_1 \cdot k_2))]$$

$$\tan(k_1 \cdot d) = \frac{(k_1 \cdot k_3 + k_1 \cdot k_2)}{(k_1^2 - k_2 \cdot k_3)}$$