

$\therefore$ do numerically -
made up a matlab m file
real-polyfactor.m

If $T(s)$ has a double pole;
create $\dot{x} = Ax + Bu$

$$y = Cx$$

to go with it

$$A = \left[\begin{array}{cc|cc} 0 & +1 & 0 & 0 \\ -d_0 & -d_1 & 1 & 0 \\ \hline 0 & 0 & 0 & +1 \\ 0 & 0 & -d_0 & -d_1 \end{array} \right] ; B = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

$$\det(sI_4 - A) = \begin{vmatrix} s & -1 & 0 & 0 \\ d_0 & s+d_1 & -1 & 0 \\ 0 & 0 & s & -1 \\ 0 & 0 & d_0 & s+d_1 \end{vmatrix}$$

$$= s \begin{vmatrix} s+d_1 & -1 & 0 \\ 0 & s & -1 \\ 0 & d_0 & s+d_1 \end{vmatrix} + (-1)(-1)^3 \begin{vmatrix} d_0 & -1 & 0 \\ 0 & s & -1 \\ 0 & d_0 & s+d_1 \end{vmatrix}$$