Problem

1. Convert $\dddot{y}+\alpha_1\ddot{y}+\alpha_2\dot{y}+\alpha_3 y=\beta_0\dddot{u}+\beta_1\ddot{u}+\beta_2\dot{u}+\beta_3 u$ to the followingmatrix form:

$$A=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -\alpha_3 & -\alpha_2 & -\alpha_1\end{bmatrix},\quad B=\begin{bmatrix}0\\0\\1\end{bmatrix},\quad C=\begin{bmatrix}(\beta_3-\beta_0\alpha_3) & (\beta_2-\beta_0\alpha_2) & (\beta_1-\beta_0\alpha_1)\end{bmatrix},\ D=\begin{bmatrix}\beta_0\end{bmatrix}$$

2. Suppose using the state variable **x** we have

$$\dot{x} = Ax + Bu$$

$$y = Cx + Du$$

Consider a change of variables **x = M z** where M is non-singular.

a) What are the new state equations?

b) Show that the transfer function did not change.