ENG EC/ME/SE 501:

Mini Quiz 2

1. Consider two linear systems having the same input $u(\cdot)$ and output $y(\cdot)$:

\[
\begin{pmatrix}
\dot{x}_1 \\
\dot{x}_2
\end{pmatrix} = \begin{pmatrix}
s_1 & 1 \\
0 & s_2
\end{pmatrix} \begin{pmatrix}
x_1 \\
x_2
\end{pmatrix} + \begin{pmatrix}
0 \\
1
\end{pmatrix} u
\]

and

\[
\begin{pmatrix}
\dot{z}_1 \\
\dot{z}_2
\end{pmatrix} = \begin{pmatrix}
s_1 & 0 \\
0 & s_2
\end{pmatrix} \begin{pmatrix}
z_1 \\
z_2
\end{pmatrix} + \begin{pmatrix}
1 \\
1
\end{pmatrix} u
\]

Find a nonsingular matrix $T$ (change of basis) that transforms the first into the second. Do you need to assume anything about $s_1, s_2$?

2. Find the $A$ and $B$ matrices associated with the standard controllable realization of the second system of question 1, and find the nonsingular matrix $T$ that relates the two state-space descriptions.

Show all work.