

Dr. Mustak E. Yalcin

Circuit and System Analysis

Exercise for Week-1

1. Consider a linear time-invariant system described by

$$\frac{d}{dt}x = Ax + Be(t)$$

where

$$A = \begin{bmatrix} 3 & -2 \\ 2 & -2 \end{bmatrix}, \quad B = \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \quad x(0) = \begin{bmatrix} 0.1 \\ -0.2 \end{bmatrix},$$

and $e(t) = \cos(2t + \frac{\pi}{3})$. Find (a) the fundamental matrix, (b) state transition matrix, (c) zero-input response, (d) zero-state response, (e) natural response and (f) forced response of $x(t)$. (f) Using MATLAB, obtain the natural and forced responses and compare with the results in (e) and (f).

PS: Example to solve the state equation using MATLAB: [LINK](#)