ECE 509 – Project 2

Analysis of Linear Systems

Logan T. Pride

April 11, 2026

1 Introduction

What do you hope to achieve/demonstrate in this project? The preparation of the following report was based on an inquiry into a project focused on transfer functions, state-space analysis, the zero-input, zero-state, and total response of a system, modal form, and the stability, observability, and controllability of a system. As these were the core concepts of the project, the writer ensured comprehensive note-taking and dedicated effort to understand each topic in full detail. The writer aims for the report to meet the instructor's expectations and believes that the simulations, studies, and research undertaken have provided the necessary skills and knowledge to fulfill all requirements for this assignment. The writer particularly valued part c, where the breakdown of the states in the state-space offered insight into the total response of the system.

2 Part 1 – Hand Derivations

Part 1: Prompted for the penmanship/handwriting of the students to be displayed. Therefore, screenshots of the report highlight the students' notebook work on certain problems that asked for hand derivations of solving.

The system given for the project is:

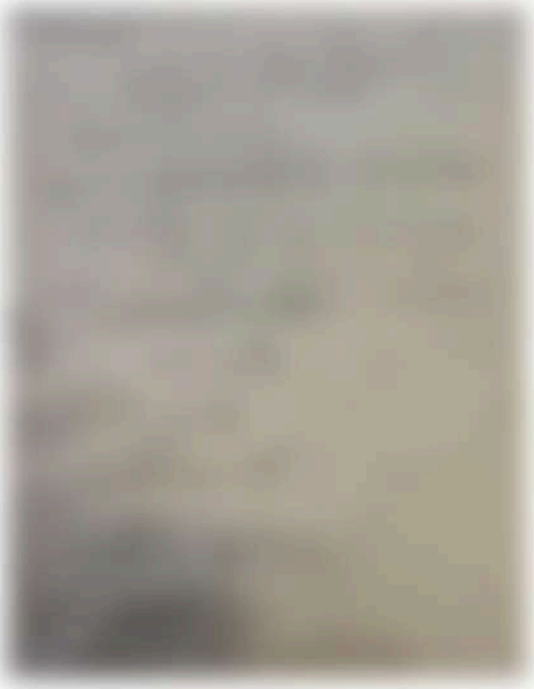
$$\dot{\vec{x}}(t) = \begin{bmatrix} -22 & 12 \\ -30 & 16 \end{bmatrix} \vec{x}(t) + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u(t) \tag{1}$$

$$y(t) = \begin{bmatrix} 1 & 0 \end{bmatrix} \vec{x}(t) + u(t) \tag{2}$$

where the system's input $u(t) = -2,\ t \geq 0$ and $\vec{x}(t_0) = \begin{bmatrix} 2 & -3 \end{bmatrix}^T$.

2.1 (a) Find the g(s) where is the Transfer Function of the system

To find the transfer function, had inquired the use of the following equation: $g(s) = C(sI - A)^{-1}B + D$. The following figure shows the process of finding the transfer function.



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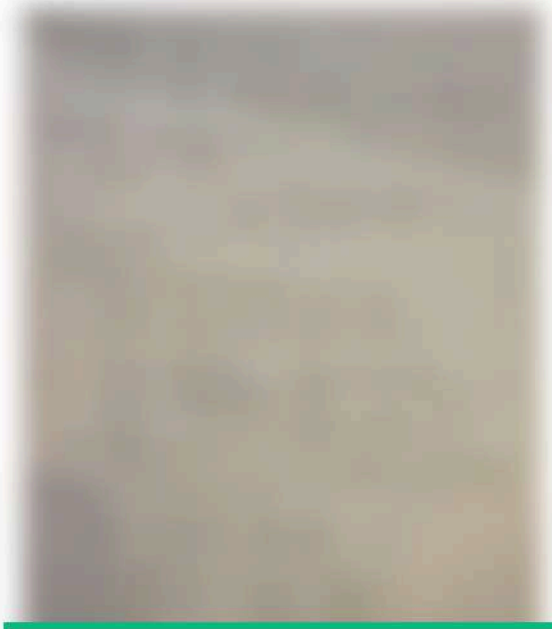

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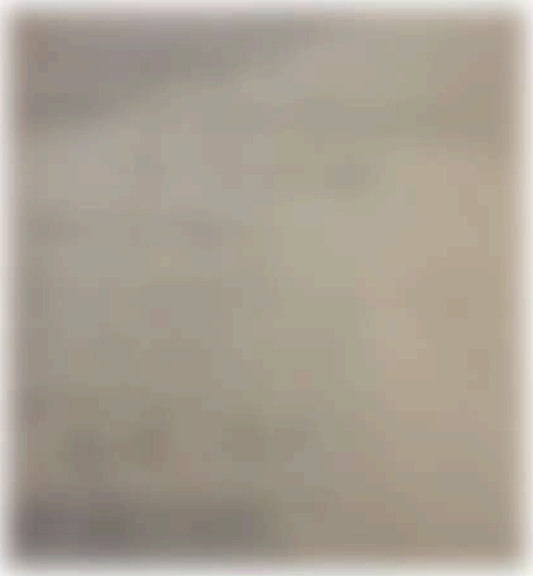

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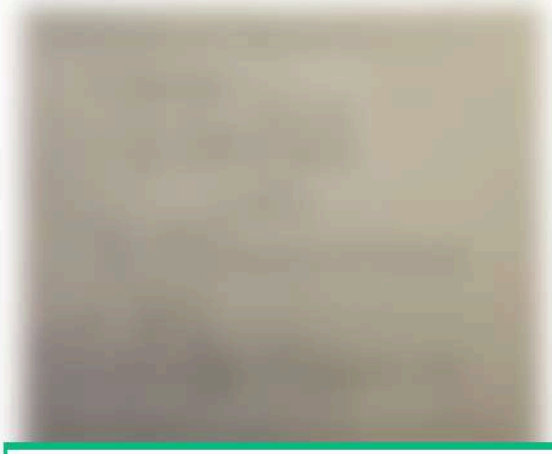

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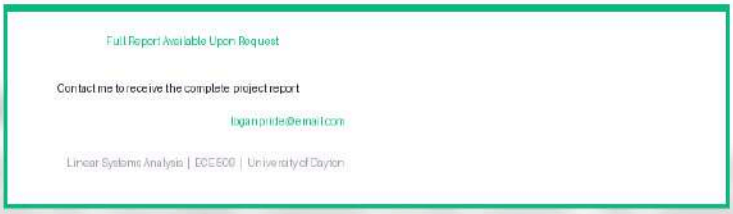
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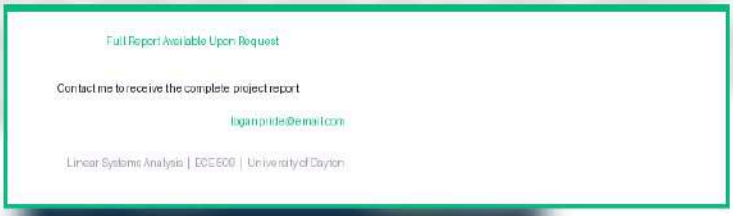
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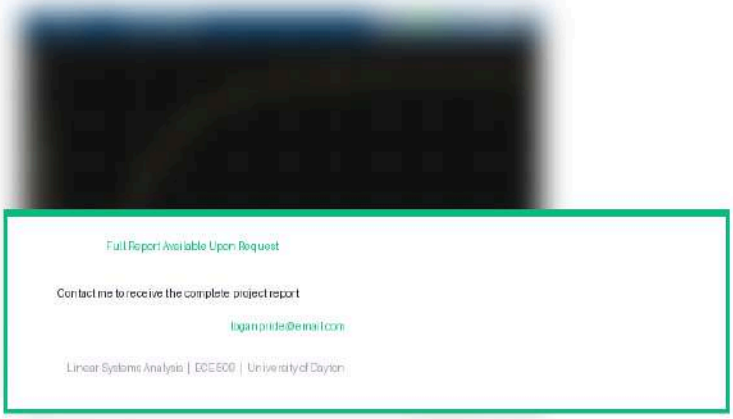
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