Hardware-in-the-Loop Plant Modeling for Autonomous Vehicle

Progress Presentation

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Outline

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Introduction

- Modeled
  - Steering Subsystem
  - Acceleration Pedal Subsystem
  - Brake Pedal Subsystem
- Not Modeled
  - Shift Subsystem
  - Speed Subsystem
  - Speed Control Subsystem
- Manual Data vs. By-Wire Data
- Neural Network Modeling [1] [2]

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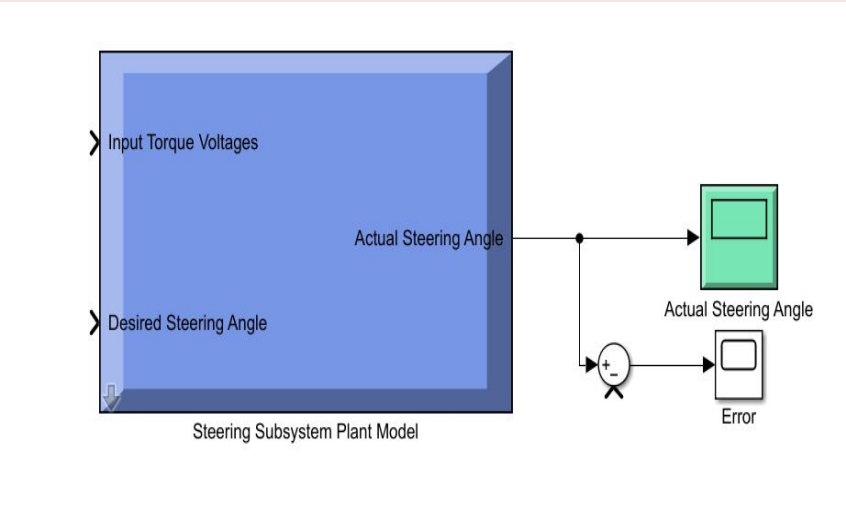
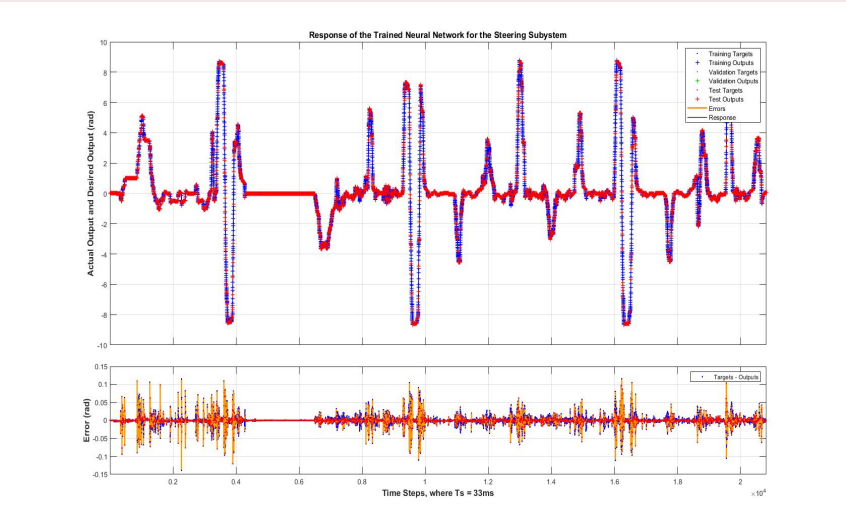
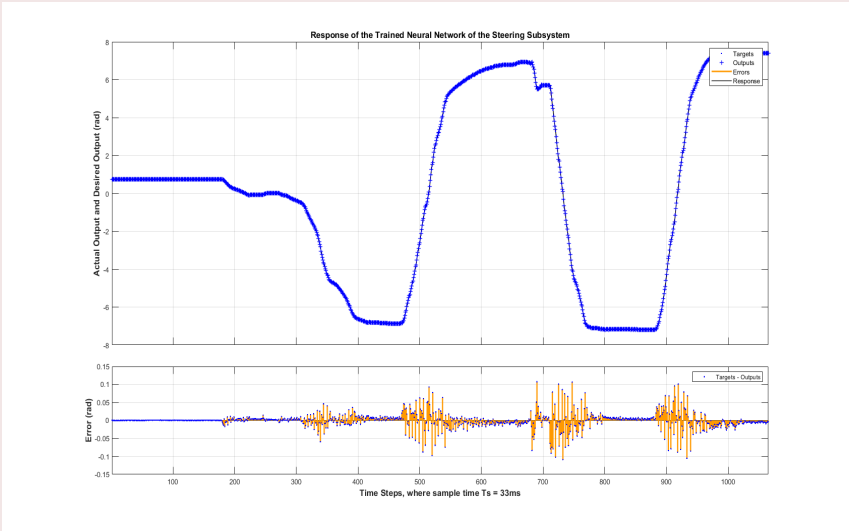
Steering Subsystem



- Only a few samples are just outside of the accuracy requirements
- Transfer function model did not meet the accuracy requirements





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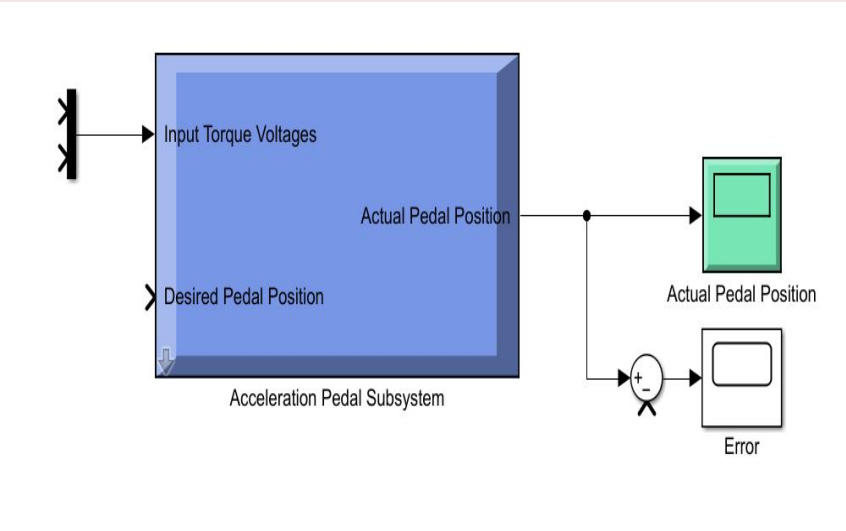
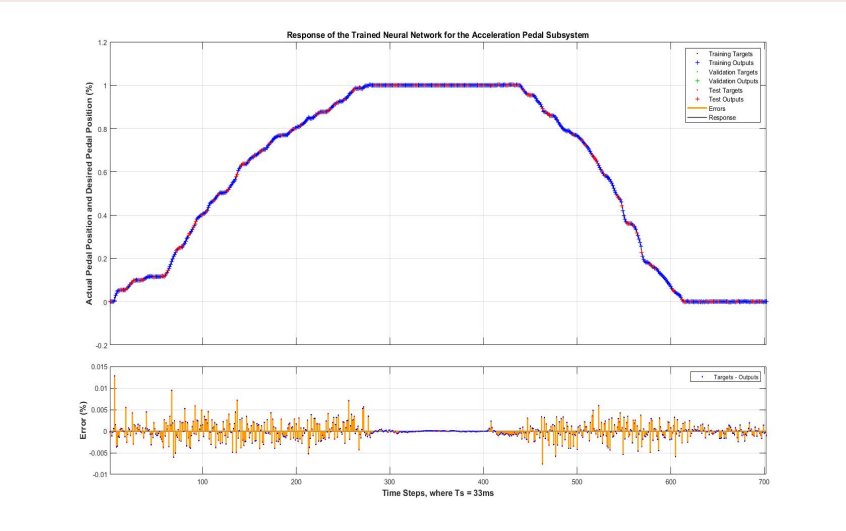
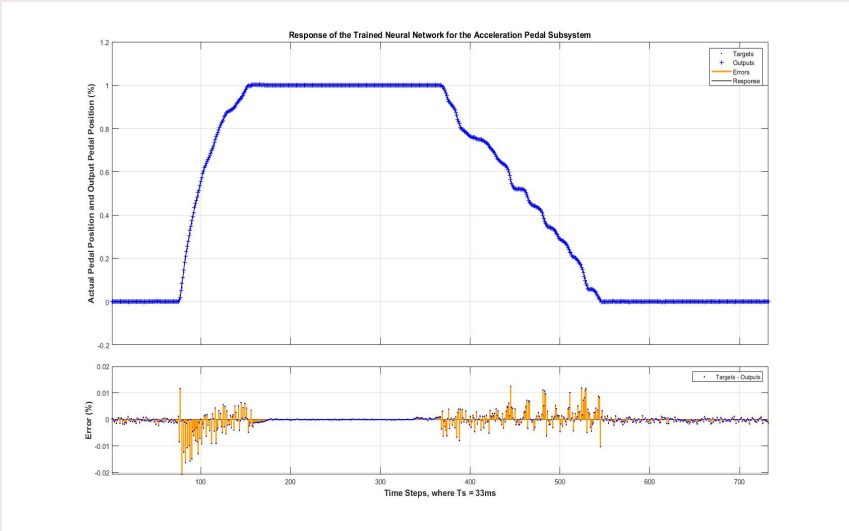
Acceleration Subsystem



- All samples within 2% of the actual output
- Transfer function model did not have the same accuracy bounds
- Fewer concerns about connections in Simulink





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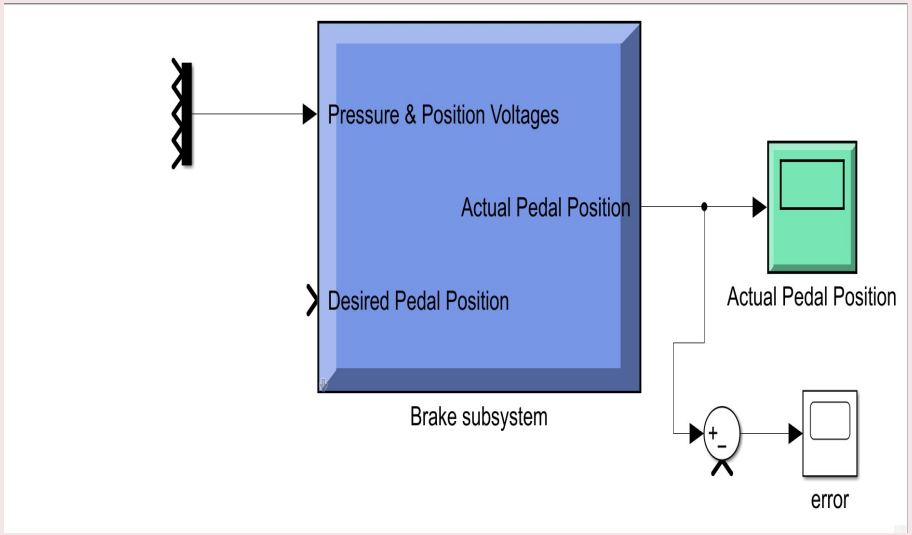
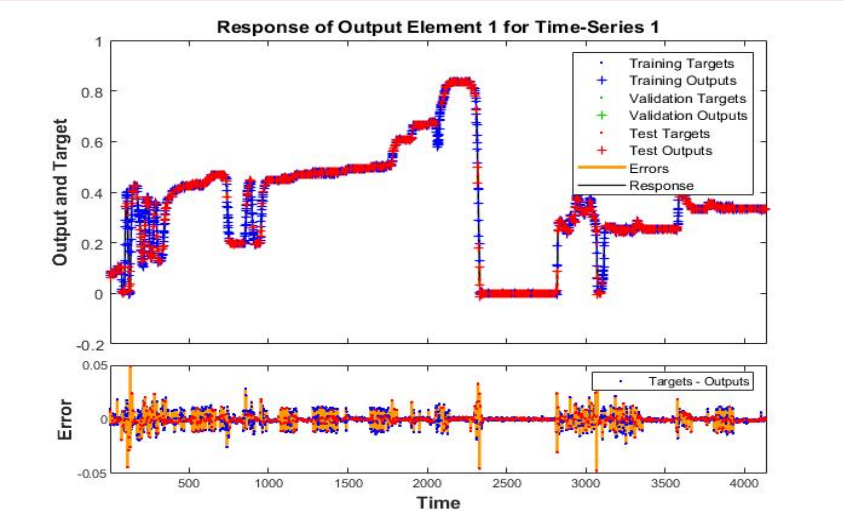
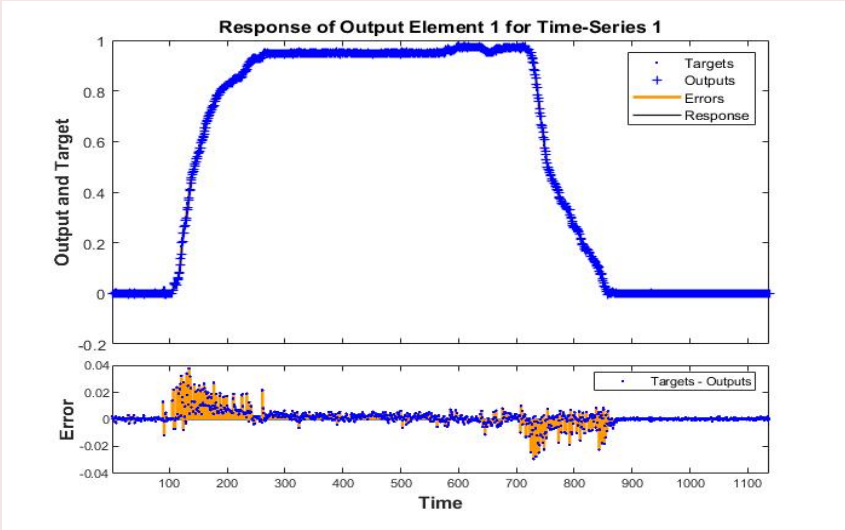
Brake Subsystem



- With this model, the error is kept below 5%
- Able to easily track model performance
- Provides better results than the transfer function model





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Concluding Remarks

Semester goals

- Test our modeled subsystems on the HIL bench
- Collect data for the remaining subsystems
- Model the remaining subsystems and test on the HIL bench
- Create final report highlighting our findings
- Present our findings

Anticipated Challenges

- Having time to model the remaining subsystems
- Needing to correct any models

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References I

[1] V. Zhou, "Machine learning for beginners: An introduction to neural networks," Dec 2019. [Online]. Available: https://towardsdatascience.com/machine-learning-for-beginners-an-introduction-to-neural-networks-d49f2

[2] "Solve nonlinear time series problem using dynamic neural networks." [Online]. Available: https://www.mathworks.com/help/deeplearning/ref/neuralnettimeseries-app.html