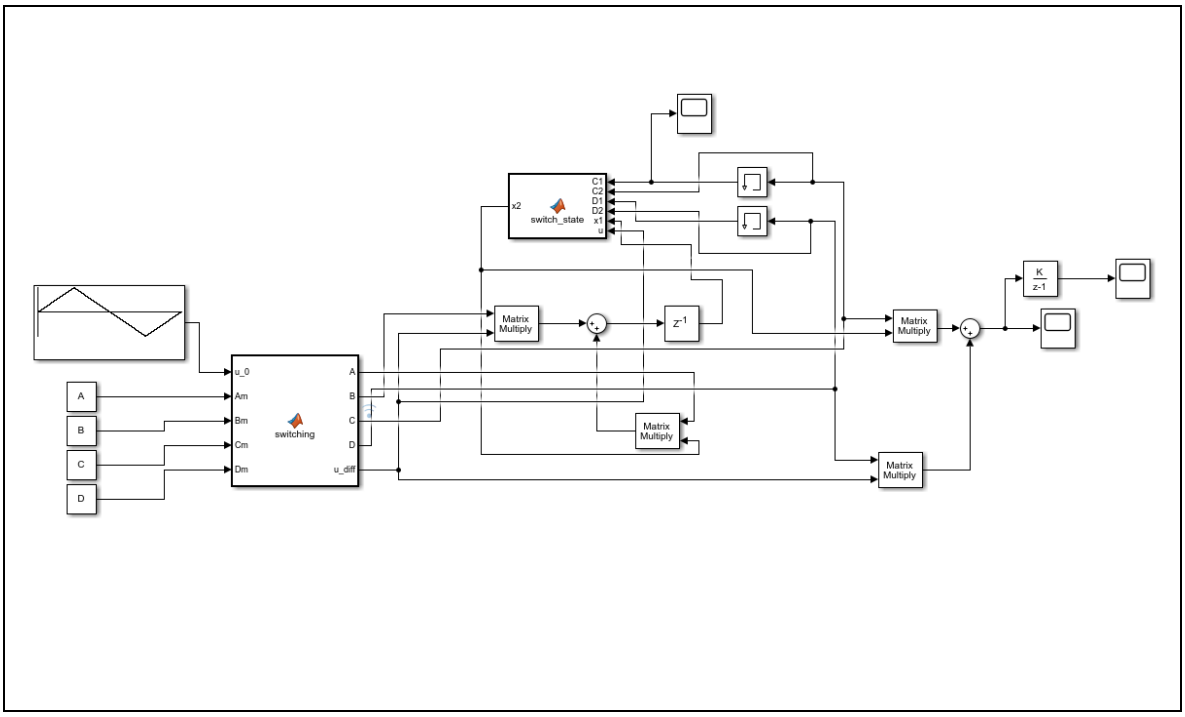
Model Reduction of a Floating Offshore Wind Farm System

Student: Ryan Lee
Date: April 15th, 2020



This study aims to create and use a network of linearized models produced from a non-linear system that accurately represents its response characteristics for controller design. The research question is "How can a non-linear high-order wind farm control system be reduced to a low-order linear model for model-based design?" Using the Eigensystem Realization Algorithm and building on existing work in model reduction and wind farm modelling, this study implements the model reduction of high-fidelity models. After validating the non-linear system, the outputs are used to generate local linearized state-space models across a spectrum of operating points before combining them in Simulink using a switching mechanism. The analysis showed that local linearization yields an accurate representation of the non-linear system characteristics and a full model that combines many linearized models with a state-space switching mechanism was feasible. We conclude that model reduction is a step towards the goal of developing a tool that can help design a controller to optimize power generation, leading to an increased likelihood of adopting offshore wind farm projects. Further optimization of key model reduction parameters can further validate the models at each point by minimizing the influence of residual oscillations.