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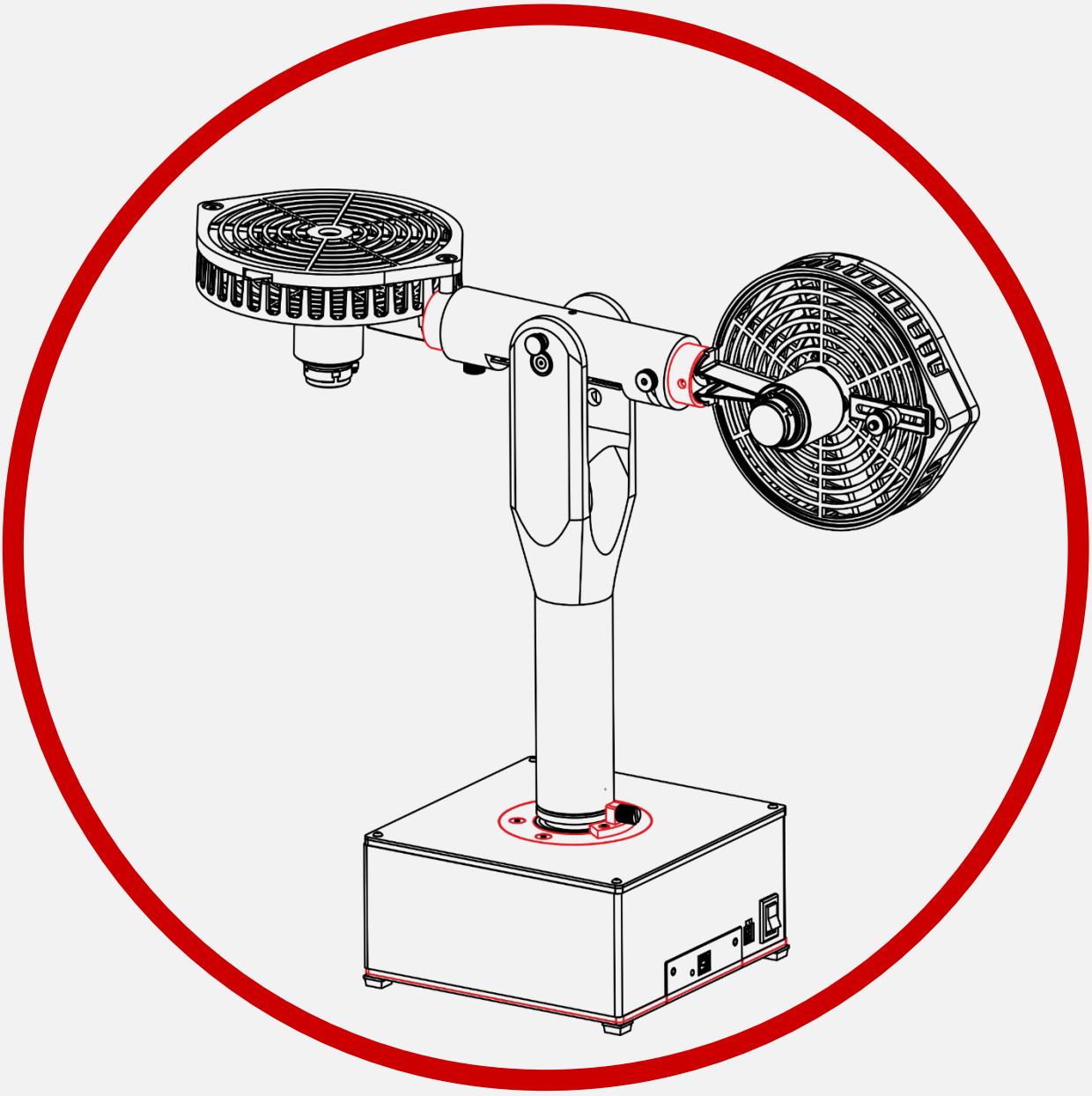

Aero 2

Block Diagram Modeling

V1.0 – 14th February 2025

Aero 2 – Application Guide

Block Diagram Modeling

Why Explore Block Diagram Modelling?

Modelling in control theory involves the use of a mathematical representation of a system as a basis for simulations. Modelling helps get information about how something will behave without actually testing it in real life. Modelling is used to design most new mechatronics systems these days. For instance, when looking at how to design a new race car to reduce air friction, a computer simulation of the car could be used to estimate the coefficient of friction in a turn with different spoilers (the air deflector wing on the back of some cars) to see which performs the best before actually building the car.

The use of modelling within engineering is well recognized. In the field of control systems, modelling is the established technique for initial control design allowing engineers to hone in on a set of control parameters, and test the predicted performance of the system. This provides a level of confidence in the response of the system with less potential for damage to the hardware once the controller is implemented on hardware. Modelling systems can save companies tons of money and improve safety in projects.

In this lab, a model will be developed for the Quanser Aero 2's rotors to relate the voltage applied to the angular speed of the propeller.

Getting started

The goal of this lab is to introduce you to block diagram modeling techniques for the Aero 2 experiment.

Ensure you have read the following concept reviews,

- Modeling (sections 1a and 1b)

Quick Review and Tips for Designing Feedback Systems

Closed loop systems in controls are feedback systems, where the output signal is sampled and then fed back in to create an error signal that drives the system. The feedback signal is mixed with the input signal (except in the case of multiple integrated closed loop systems), which is either a voltage or a current (in this case voltage for the purpose of this lab). When designing a feedback system, understanding the elements that are feeding back into the system and where they feedback into the system, allows for faster modelling. In the case of this simple cruise control feedback system in Figure 2, naming the inputs and outputs to the blocks modelled allows for easier tracking of the variables in a system when building systems off of derived equations.

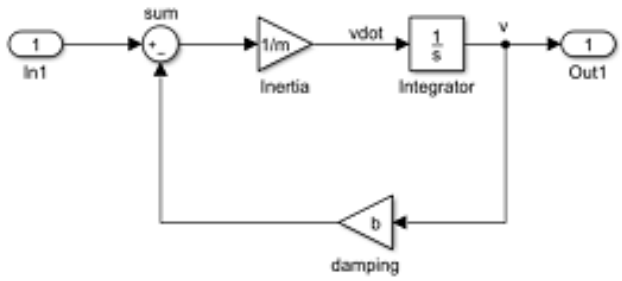

Figure 1: Cruise Control Feedback System from Control Tutorial for Matlab/Simulink