

## ABSTRACT

Simulation is very useful in the analysis of a system one of which is a control system. Before a control system is implemented, the system needs to be tested repeatedly to get the desired results. To prevent damage from repeated testing, we need a simulation technique that can reduce this risk. Hardware in the Loop (HIL) simulation techniques can meet these criteria.

Hardware in the Loop is a technique of combining hardware and software in one simulation process. The hardware that will be used is Arduino which also functions as a controller. While the plant in the form of a ball and beam system (BBS) which is modeled is then designed on Simulink. The simulation results will be displayed on the scope in real-time. For interfacing hardware and software DAQ is used, so that physical signals can be processed virtually and virtual signals can be processed in physical form.

Based on the results of research conducted, HIL simulators designed with Arduino, Simulink, and DAQ can run simulations in real time. The application of LQR control to the plant can stabilize BBS in simulation testing, HIL, and real plant. The application of LQR control causes BBS to be a damped system and can reach steady conditions within 1,365 seconds in testing with HIL, and 1.06 seconds in a real plant.

**Keywords:** *linear quadratic regulator, hardware in the loop, Simulator, plant, ball and beam system*