

Electro-Hydraulic Proportional System Real Time Tracking Control Development Based on Pulse Width Modulation Method

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Abstract

The present work is directed to develop the dynamic performance of an electro-hydraulic proportional system (EHPS). a mathematical model of (EHPS) is presented using electrohydraulic proportional valve (EHPV) by the aim of Matlab-simulink which facilitate the simulation of the hydraulic behavior inside the main control unit. Experimental work is done and closed loop system is designed using linear variable displacement transducer sensor (LVDT). The controller of the system is an Arduino uno which is considered as the processor of the system. The model is validated by the experimental system. The study also presents a real time tracking control method based on pulse width modulation by controlling the speed of the actuator to achieve position tracking with minimum error.

Full Text

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Figures

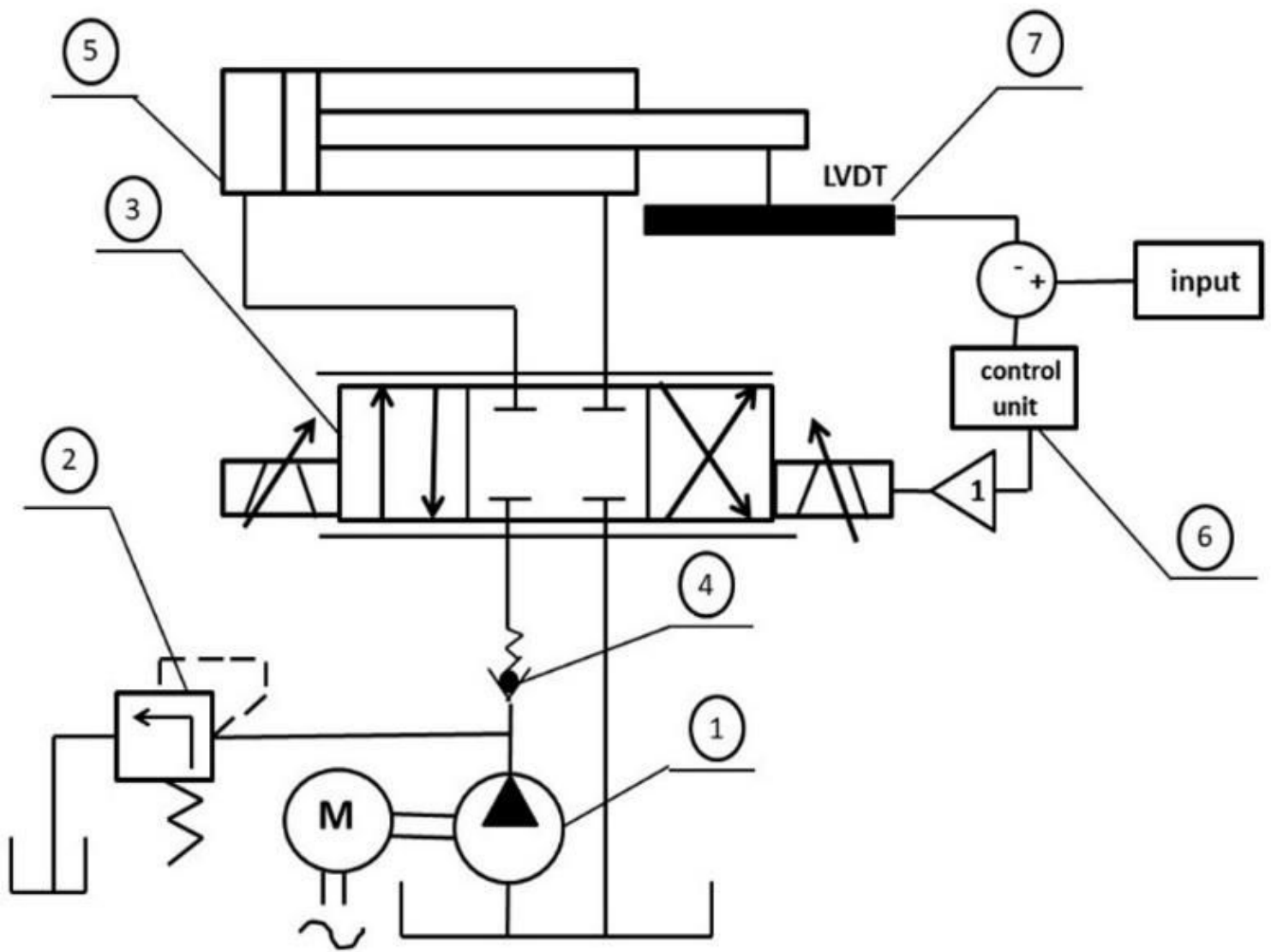


Figure 1

EHPS hydraulic circuit

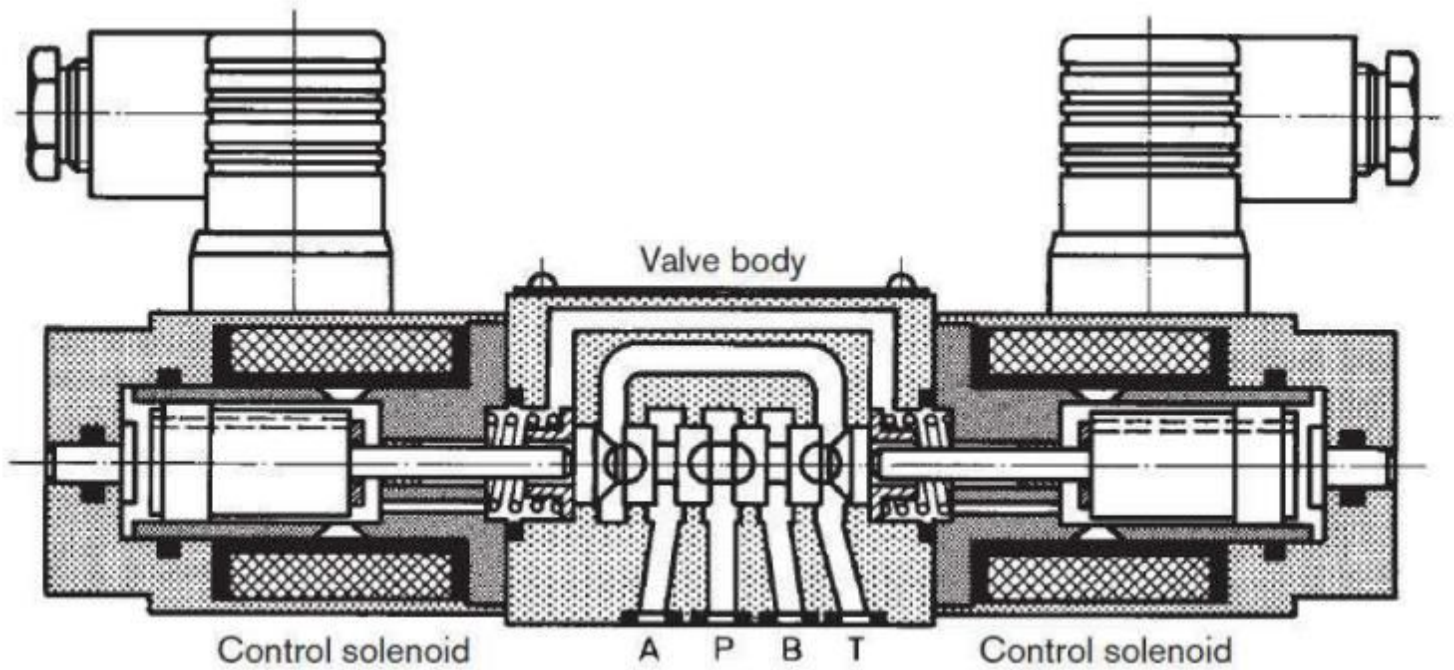


Figure 2

typical electrohydraulic proportional valve

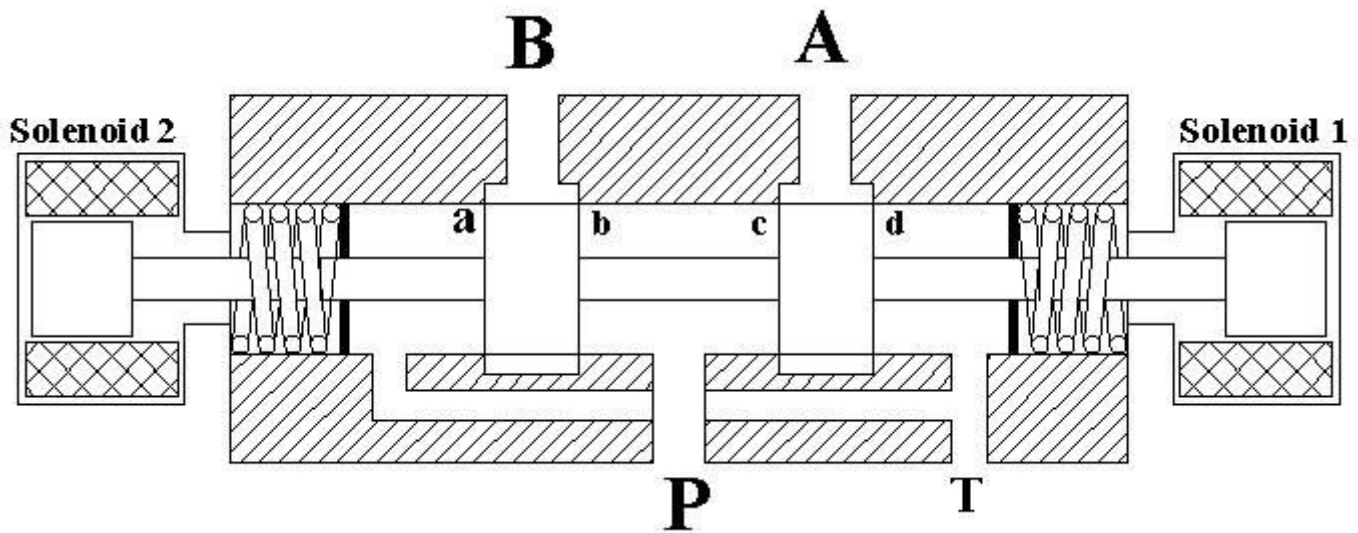


Figure 3

proportional directional valve Internal orifices

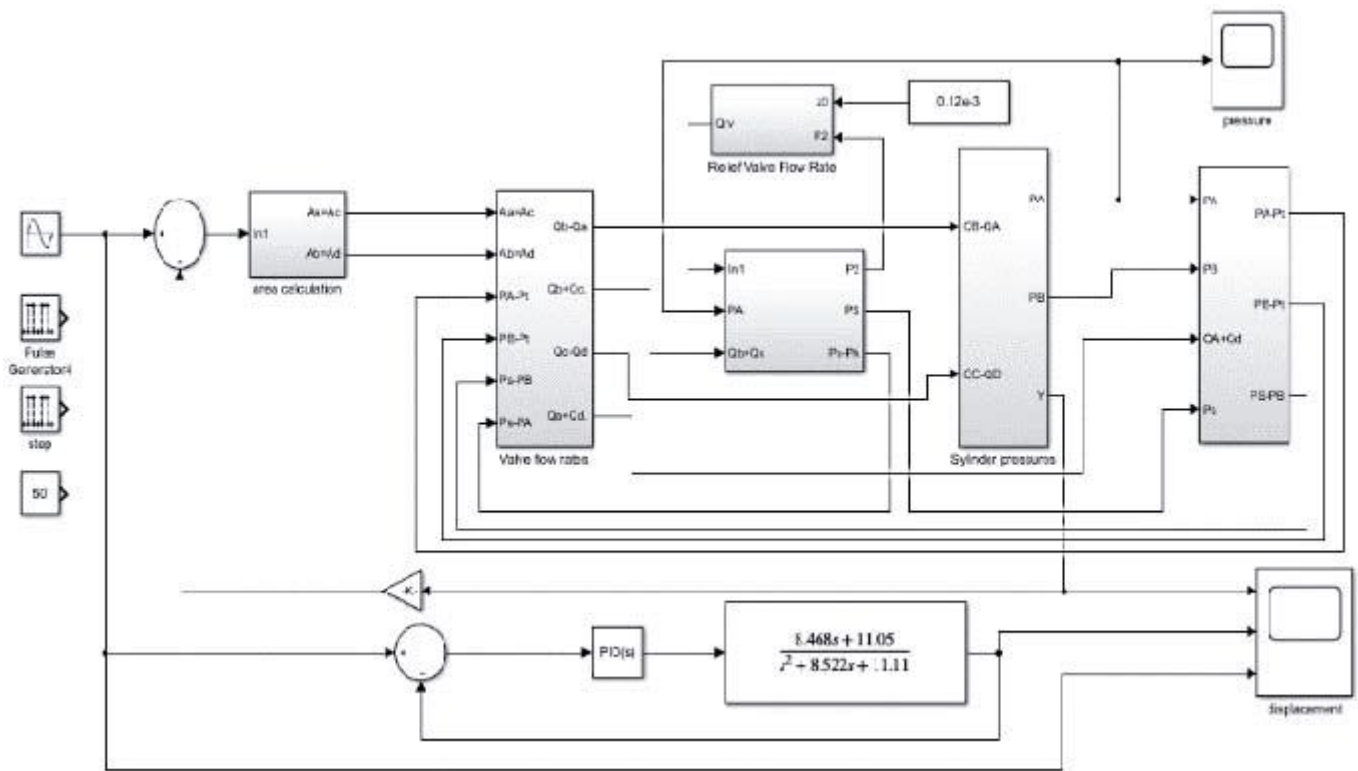


Figure 4

EHPS mathematical model code

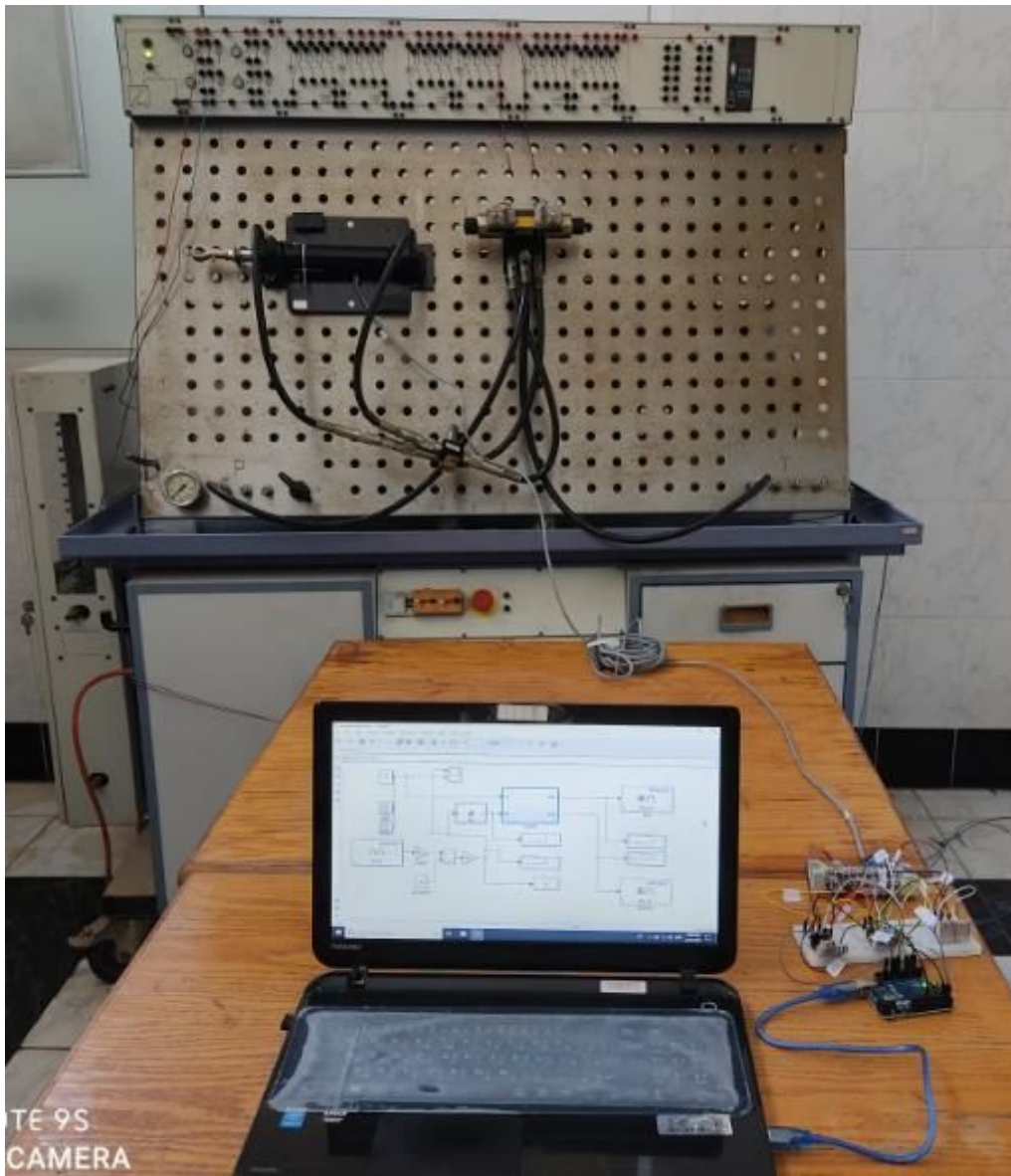


Figure 5

Electrohydraulic test rig

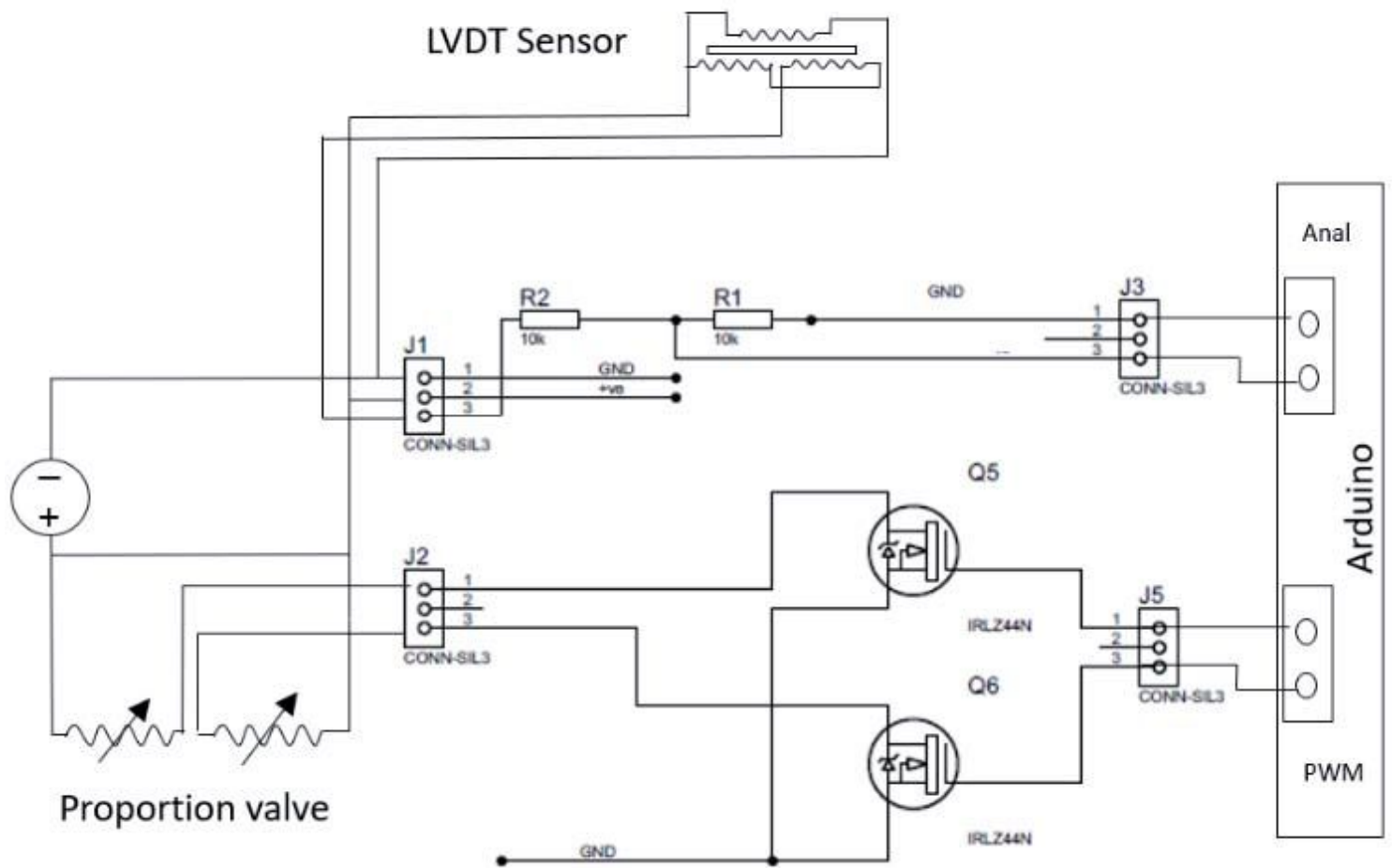


Figure 6

Electric circuit for controlling the system

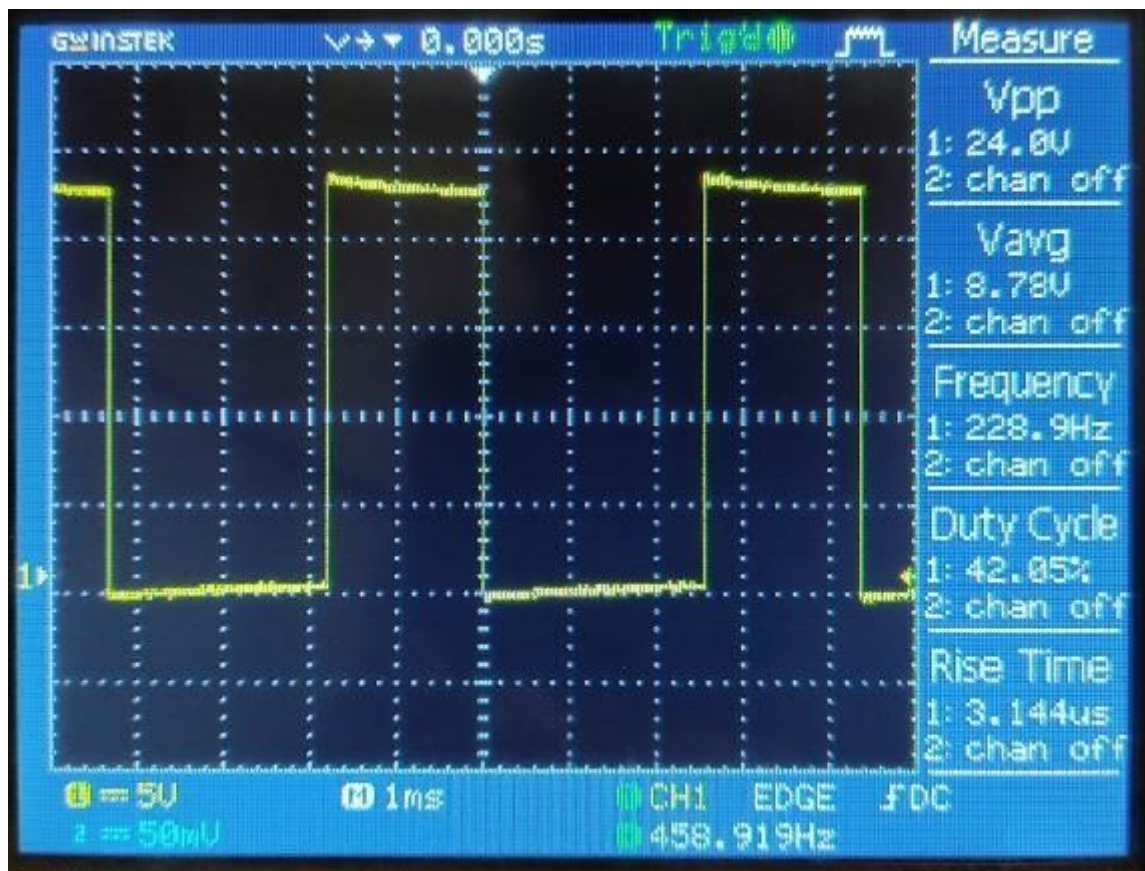


Figure 7

Pulse width modulation input signal 180

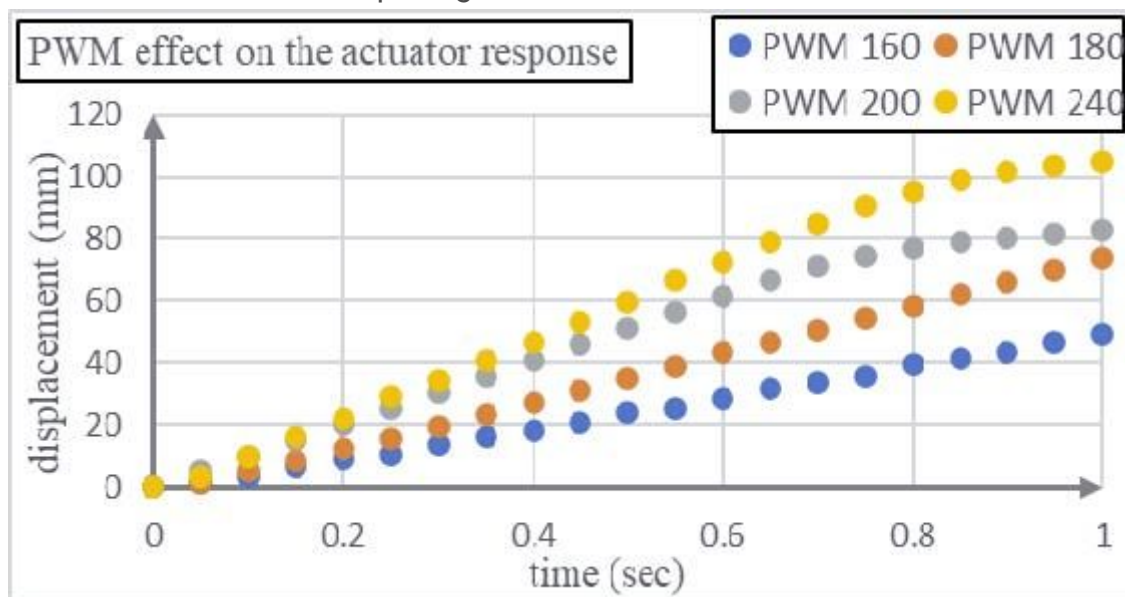


Figure 8

Effect of pulse width modulation on actuator speed

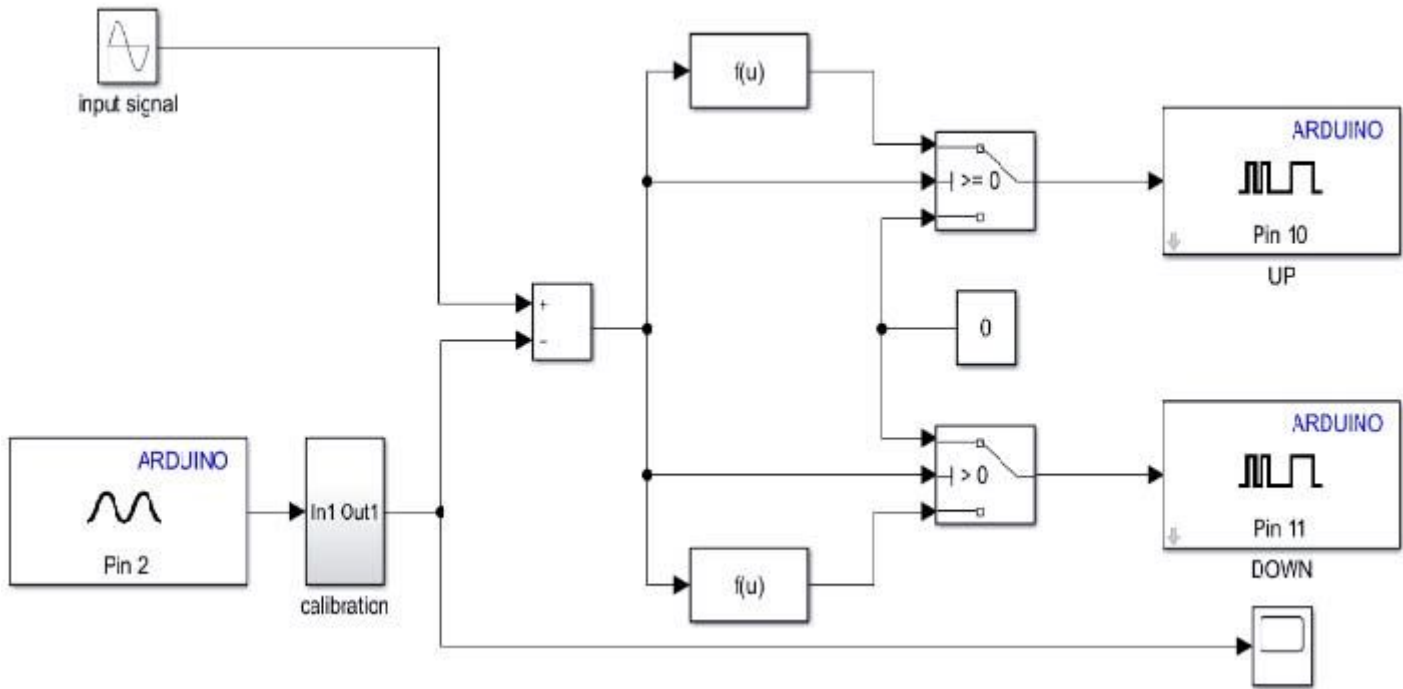


Figure 9

EHPS controlling code

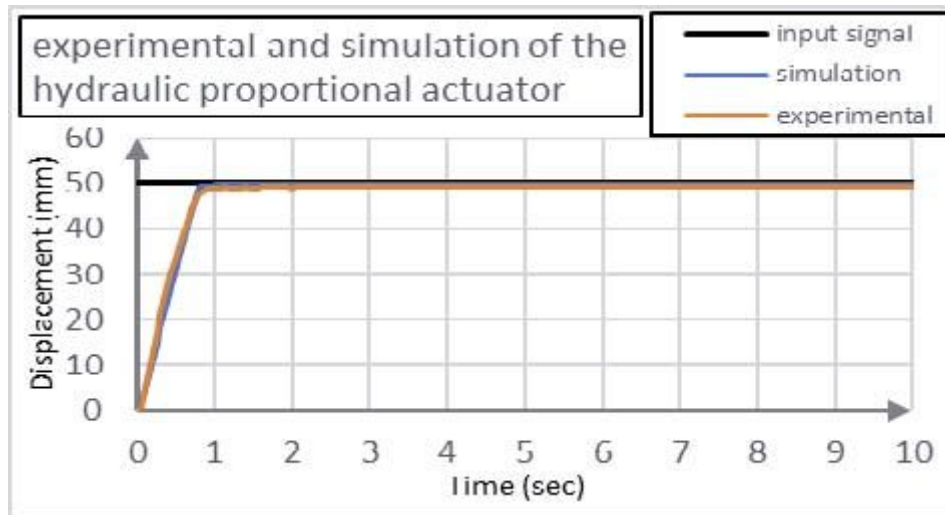


Figure 10

Hydraulic actuator response by applying constant input of 50 mm

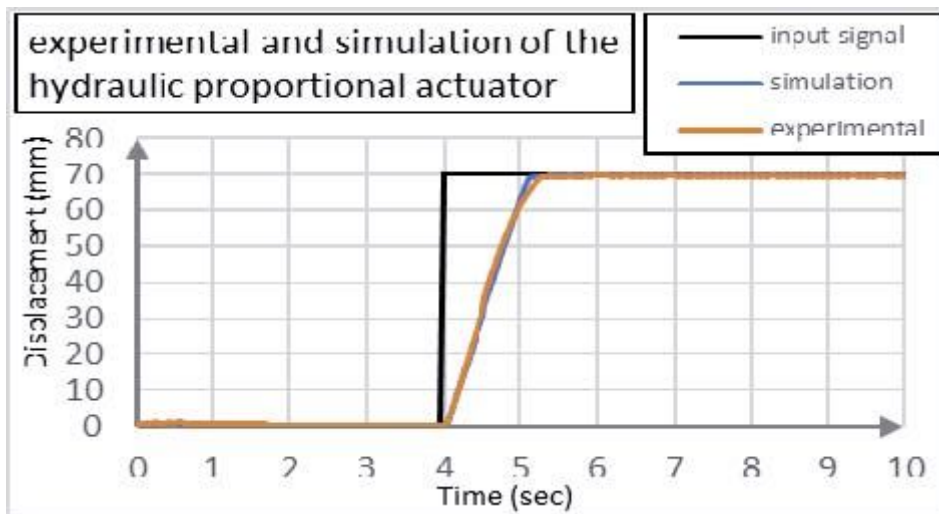


Figure 11

Hydraulic actuator response by applying step input of 70 mm

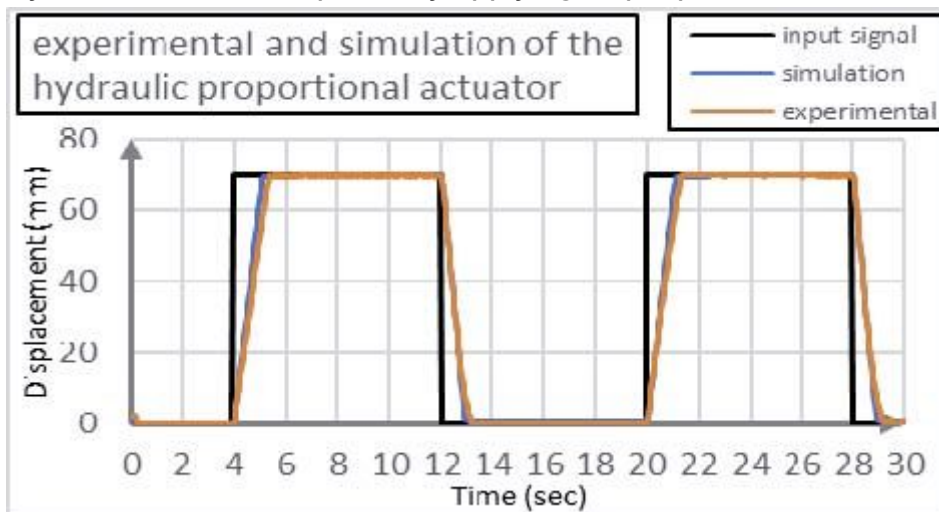


Figure 12

Hydraulic actuator response by applying square input of 70 mm

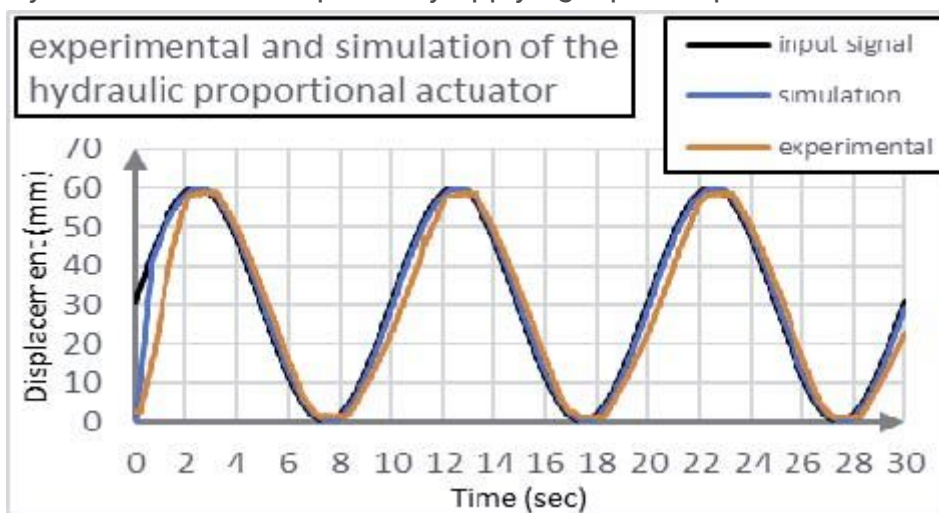


Figure 13

Hydraulic actuator response by applying sinusoidal wave input of 30 mm amplitude and 30 mm bias with frequency) 0.08 HZ

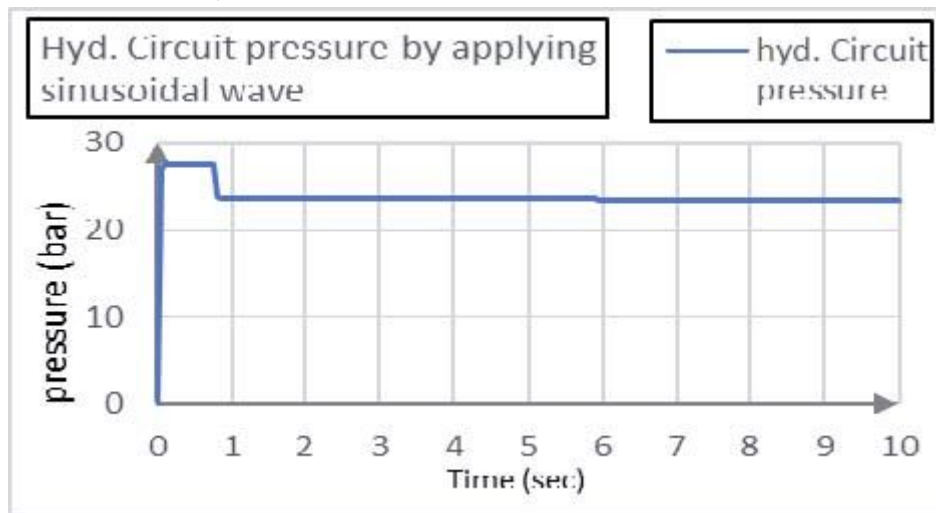


Figure 14

Hydraulic circuit pressure behavior by applying constant input of 50 mm.

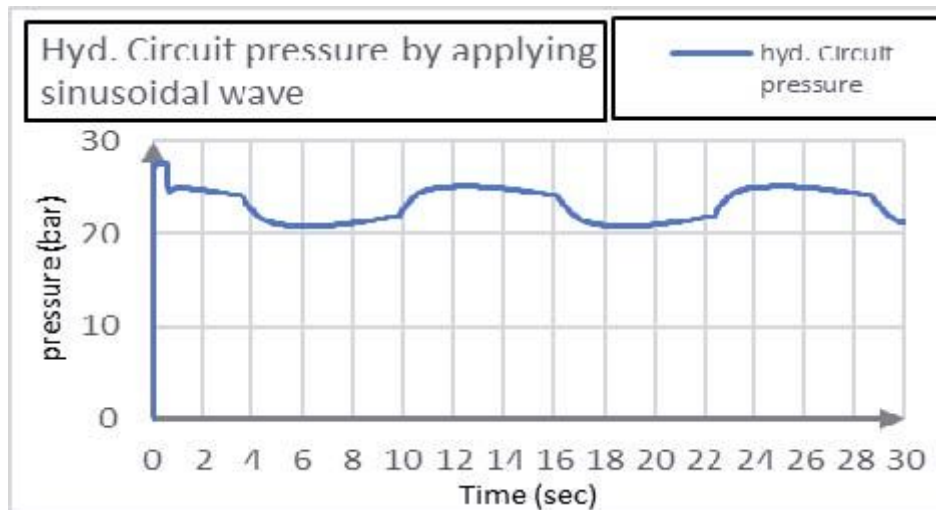


Figure 15

Hydraulic circuit pressure behavior by applying sinusoidal wave input of 30 mm amplitude and 30 mm bias with frequency) 0.08 HZ