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2019 6th International Conference on Mechanical, Materials and Manufacturing IOP Conf. Series: Materials Science and Engineering 689 (2019) 012011 IOP Publishing doi:10.1088/1757-899X/689/1/012011

Fast Switching Valve Utilization to Control Pneumatic Cylinder Speed

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Abstract

The position and speed of the piston of pneumatic cylinder are very important parameters in evaluating the pneumatic system performance. Utilization of Pulse Width Modulation (PWM) technique to control the Fast Switching Valve (FSV) usually causes fluctuation in the piston motion and accordingly, the system performance deteriorates. The objective of this work is to introduce a novel PWM control technique considering the suitable duty cycles according to the switching frequency in order to improve the FSV characteristics and reduce piston speed fluctuation. A test rig for a simple pneumatic circuit with an FSV as a control element has been designed and realized. The displacement of the piston is measured using a Linear Wire Potentiometer Transducer (LWPT), while its derivative is used to estimate the speed considering a low pass filter to reduce the effect of piston position signal noise. A nonlinear mathematical model is introduced and experimentally validated. The results of both computer simulation and experimental measurements show that the integration between fast switching valve and PWM control signal leads to a quasi-linear relationship between duty cycle and piston speed. Moreover; results proved the successful control of piston speed based on the correct duty cycle and valve switching frequency

ISATRANS-D-19-00548 2019, November