Visveswaraiah Technological University, Belgaum

Project Report On

INVESTIGATION ON HYDRAULIC DISPLACEMENT AMPLIFICATION OF PIEZO-ACTUATOR FOR MICRO/MACRO POSITIONING APPLICATION

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Submitted to Visveswaraiah Technological University in partial fulfilment of the requirements for the award of Bachelor of Engineering Degree in the field of Mechanical Engineering.

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MAY 2011

ABSTRACT

Piezoactuators are widely used in different engineering applications because of their high dynamic response, higher positioning accuracy, high stiffness, low wear and tear and compact design. Also, displacement of the piezoactuator is proportional to the applied voltage and hence it can be estimated using suitable piezoactuator model. However, piezoactuators have limited displacement which makes them suitable only for micro and nano positioning systems. Present positioning applications demand macro positioning range with micro/nano positioning accuracy. In the present project work, an effort is made to investigate the displacement amplification of a piezoactuator using hydraulic amplification principle. Hence the main objectives of this project work are: to develop a piezoactuator with hydraulic displacement amplification mechanism also to investigate the static and dynamic behaviour of the actuator.

The actuator is supplied with certain voltage through electric drives which in turn drives the actuator causing displacement. Actuator is connected to diaphragm, as actuator displaces, it pulls the diaphragm along with it. The oil which is present in between diaphragm and piston occupies the displaced volume of diaphragm causing hydraulic displacement of piston in the upward direction. The displacement of oil is such that it moves from larger volume to smaller volume which in turn causes the amplification of the displacement. This amplified displacement of piston is recorded using certain measuring instrument. Hence with this prototype actuator with hydraulic amplification mechanism can be used for micro/macro applications which widen the limits of the actuator.