DESIGN AND OPTIMIZATION OF LINEAR ACTUATOR FOR BIOMEDICAL APPLICATIONS

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Microelectromechanical system (MEMS) actuators are a promising innovation that is essential to the development of a wide variety of biomedical devices. The invention of smaller fluid pumps has been valued with increasing interest, these miniaturized micro pumps are designed to handle a very small, precise, and controllable amount of fluid normally in the range of µl/min to ml/min. Thyroid hormone imbalance is a highly increasing, common, genetically or non-genetically disease, which is conducted to Hypothyroidism (an underactive thyroid gland) and Myxedema Coma. So, levothyroxine should be injected frequently into the human body to maintain the metabolic system. This research was carried out to design a linear actuator for a micro pump that injects a certain dose of levothyroxine hormone into the human body accurately. Lead Zirconate Titanate (PZT) gives a high piezoelectric charge coefficient value with high frequency and stiffness that is required for the micro pump. Theoretical mathematical calculations of the piezoelectric stack configuration were carried out to get the displacement of the actuator and maximum displacement. Considering water as the fluid, an equation for flow rate was derived theoretically with supposing fluid behave as a laminar flow. Finite Element Analysis (FEA) was performed to identify the suitable dimensions of the micro pump which is compatible with the flow rate of the fluid.

Keywords: