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Piezoelectric Actuator for Controlling Robotics Organs

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Abstract : In precision engineering, including precision positioning, micro-manipulation, robotic systems... a majority of these applications actuated by piezo stack used the compliant amplifier mechanism to amplifying motion and guiding it as needed utilize the flexibility of their components, in this paper, we present a novel approach introducing a symmetric structure comprising three stages, featuring rectangular flexure hinges with a compact size of 77mm×42mm×10mm. This design provides the capability for rotation, translation or a combination of both movements in both directions. The system allows for a displacement of 2107.5 µm when the input displacement of PZT is 50 µm while considering the material constraints of the aluminum alloy (7075 T6) which has a maximum admissible stress of 500 MPa However, our proposed design imposes additional constraints to ensure the stress remains below 361 MPa for optimal performance. These findings were obtained through finite element simulations conducted using ANSYS Workbench. Furthermore, our module facilitates precise control of various components within robotic systems, allowing for adjustable speeds based on specific requirements or desired outcomes.

Keywords : robotic, piezoelectric, compliant mechanism, flexure hinge
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