Abstract Book

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Design and modeling of an efficiency horizontal thermal micro-actuator with integrated piezoresistors for precise control

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Since the introduction of Micro / Nano -Electro-Mechanical system (MEMS and NEMS) fabrication technique, numbers of very small mechanical devices have been built with the purpose of high performance for specific applications of interests. Furthermore, structure compatibility of sensors to actuator has also profited greatly to performance evaluation and controlling in real time.

Thermal actuation attracts the most attentions for generating large displacement with low power consumed in practical applications, including scanning tunneling microscope, tilting micro-mirror and actuations of microprobes. In this paper, we propose a horizontal thermal micro-actuator with self test functions based on piezoresistive effect to achieve a good control for micro / nano-positioning of the platform.The integrated piezoresistor at the base of the 'cold arm'can monitor the horizontal movement of the system where no Joule heating passing through, which can further characterizethe actuator response precisely in real time and eliminate the arrangement of the measurement setup off chip. The electro-thermal-mechanical modeling and optimization is developed to elaborate the operation mechanism of the hybrid system through numerical simulations. The high performance and self - evaluation of the thermal actuator presented here illustrate a good prospect of application and extension in MEMS / NEMS field. .

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