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PERFORMANCE EVALUATION OF TWO TYPES OF MEMS MICRO SWITCHES FOR RADIO FREQUENCY APPLICATIONS : A SIMULATION STUDY

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ABSTRACT

In our work, simulated models of fixed-fixed and clamped-clamped micro-beams are designed and studied for radio frequency (RF) switching. These types of micro-beams are used in MEMS based micro switch applications, resonator sensors, relay switches, etc. Micro-switches and micro resonators are used in IC chips, which are used in mobile phones, wireless networks and fiber optics communications. In micro-switching operation, when the input voltage exceeds a critical value, a deflection takes place due to thermal expansion of the metal beam and the switch achieves either ON or OFF state. First we have designed a fixed-fixed micro-switch of length 350 µm with 20µm width and fixed between two metal plates. Similar way, 350µm copper beams having same with of fixed-fixed clamped at its ends in the clamped-clamped configuration. Both these structures are developed in simulation based MultiPhysics software platform. In order to study the mechanical characteristics of the fixed-fixed and clamped-clamped configurations, the deflection of the beam at different applied voltages are observed. Initially a potential of 0.2Volts is applied between the plates which heats up the beam which has induced stress as thermal load within the material.

ABSTRACT

This stress causes the beam to expand and deform according to the strength of applied voltages. Here we have increased the voltage in steps of 0.2Volts till 2Volts in both cases and the corresponding displacements at different voltages are noted. A comparative study on the pull-in and pull-out voltage for switching of these two types of micro-beams has been performed.

Keywords: MEMS micro switches, fixed-fixed, clamped-clamped beams

INTRODUCTION

MEMS microswitches are employed in many applications such as in cell phones, wireless networks, fiber optic communications and multiplexed networks[1]. The major functions of MEMS microswitches are switching, filtering and tuning. The MEMS microswitches can be a good substitute of traditional electronic switches such as diodes and transistors since they present an improved insertion loss and good isolation during the ON/OFF switching states[2]. RF MEMS Switches overcome the limitations of existing conventional electronic switches and has several advantages such as low power consumption and high isolation. The structural elements used in MEMS devices are simple elements like beams, plates and membranes[3].