A Numerical Approach to the Efficient Analysis of 2D RF-MEMS Capacitor with Accelerated Motion

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Introduction

In recent years, the growth of Micro Electro Mechanical System (MEMS) technology significantly give an impact in every category of applications especially in radio frequency (RF), information technology (IT) and micro-sensors[1],[2]. However, the simulation and dynamic analysis of RF MEMS components are still a critical issue that need to be dealt as to solve many intriguing problems of high-frequencies technology especially in wireless communications. The conditions for a solution to this issue, it commands a stringent requirement in terms of efficiency and accuracy of the numerical analysis. The conventional numerical techniques has limitation for the time changing boundaries, hence the difficulty to solve these problems numerically for electromagnetic fields. Presently, the computational techniques for moving boundary problems have been pursued mainly in heat and fluid area [3]. Here, a new numerical approach, which is the body-fitted grid generation method with moving boundaries are being developed with the aim of combining the advantages of the Finite-Difference Time-Domain (FDTD) techniques [4]. With this method, finite difference can be solved very easily on a square grid in a rectangular computational region regardless of the shape and configuration of the physical region.

An efficient numerical approach has been proposed and presented for the analysis of 2D comb structured MEMS variable capacitors with accelerated motions [5]. These comb structured variable capacitors consists of two plates, which is the static plate and the movable plate that suspended with the spring. By using this numerical approach, it is possible to analyze the combined effect of the mechanical and electrical forces. In this paper, at first, the relation of the acceleration of the plate and the bias voltage are derived and the numerical results and theoretical results are agreed very well. The relation between the oscillations of the frequency with the acceleration is also shown.

Modeling of the Proposed 2D MEMS Capacitor

A schematic diagram of the proposed MEMS capacitor is shown in Fig. 1. The upper plate was suspended by a spring. A bias voltage has been applied between

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