Abstracts

Large-displacement modelling and simulation of micromechanical electrostatically driven resonators using the harmonic balance method

T. Veijola, T. Mattila, O. Jaakkola, J. Kiihamaki, T. Lamminmaki, A. Oja, K. Ruokonen, H. Seppa, P. Seppala and I. Tittonen. "Large-displacement modelling and simulation of micromechanical electrostatically driven resonators using the harmonic balance method." 2000 MTT-S International Microwave Symposium Digest 00.1 (2000 Vol. I [MWSYM]): 99-102.

Nonlinearities in electrostatically driven micromechanical resonators are studied with circuit simulations. Models for the resonators are built of elementary electrical equivalent-circuit blocks constructed of nonlinear voltage-controlled current and charge sources. They are simulated with the harmonic balance method in the RF-simulation program APLAC. Spring softening effects due to the capacitive transducer and spring hardening effects due to the resonator's third order spring coefficient are demonstrated by simulations. For verification, a model for a micromachined high-Q beam resonator structure has been constructed, and its measured large-displacement frequency-domain transfer characteristics are successfully reproduced by model simulations.

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