ACOUSTICS2008/1234
Modelling of radiofrequency MEMS bulk acoustic wave resonators with Legendre polynomial method

Antoine Raherison[a], Faniry Emilson Ratolojanahary[b], Jean-Etienne Lefebvre[a], Lahoucine Elmaimouni[c] and Tadeusz Gryba[a]
[a]IEMN - DOAE, Université de Valenciennes, Le Mont - Houy, 59313 Valenciennes, France
[b]LAPAUF, Universite de Fianarantsoa, 301 Fianarantsoa, Madagascar
[c]Faculte polydisciplinaire d'Ouarzazate, Universite Ibn Zohr, BP 638, Ouarzazate, Morocco

Radio-Frequency electro-acoustic resonators and filters are key components for wireless communication devices. The next generation of mobile systems requires for these components a strict size reduction, higher operating frequency and better power resistance. So, MEMS BAW (Bulk Acoustic Wave) devices have emerged as an efficient alternative to established Surface Acoustic Wave filtering solutions. Knowledge of the electromechanical coupling coefficient and the Q-factor are of primary importance for the MEMS BAW device design. In our model, the Legendre polynomial method which describes the structure and incorporates automatically the boundary conditions in constitutive and propagation equations is used to calculate these parameters. It is the first time this method is applied to study standing rather than propagative waves. The advantage of this approach are, in a unique formulation, to take into account the presence of sources, existence of electrodes' losses and dissimilarity of the constituent materials of the resonator. To validate this approach, it is applied to a Al/ZnO/Al resonator. Through harmonic and modal analysis, the influence of electrodes properties on MEMS BAW resonator performances are illustrated; the results are compared with those published earlier. This method is an efficient tool for designing MEMS BAW filter.