

Frequency tuning of Surface Acoustic Wave resonator by utilizing nonlinear effect

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Abstract. Force-velocity effect, as one of the nonlinear effects of surface acoustic wave resonator, represents Stress-induced surface acoustic wave velocity shifts. This effect could enable a surface acoustic wave pressure sensor with high sensitivity and accuracy. In addition, being able to manage and manipulate this effect would enable us to control acoustic wave in a low-loss and scalable manner that can contribute to the recent development of acoustic integrated circuits [1]. In this paper, we have theoretically analyzed the force-velocity effect of lithium niobate SAW resonator. Experimental measurement of a variety of lithium niobate Saw resonators has been conducted to verify the theoretical results. Furthermore, this work also present analysis results for the electroacoustic effect lithium niobate SAW resonator. Optimal material orientation and wave propagation angle that would enable the maximum electroacoustic effect is presented.

[1] Shao, Linbo, Di Zhu, Marco Colangelo, Daehun Lee, Neil Sinclair, Yaowen Hu, Peter T. Rakich, Keji Lai, Karl K. Berggren, and Marko Lončar. "Electrical control of surface acoustic waves." *Nature Electronics* (2022): 1-8. Cooler A. S. (1999) Binary Flow Systems. *J. Fluid Mech* 999:999-996.