Development of Microresonator-Based Logic Gates Using Signal Conditioning Circuits

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Most computation in electronic devices is performed using transistor based logic gates. However, due to physical limitations on transistor's size, it will be impossible to develop the transistor based logic gate in the future. MEMS logic gate promises hardware reconfigurability and the ability to work in harsh conditions. However, its deficiency of producing weak signals (μV) makes it unusable. This project focuses on developing an amplifier circuit aiming to amplify MEMS logic gate's signal and to be integrated with it. Adjusting the feedback resistor and the gain resistor of the amplifier changes the gain, hypothetically (104). The developed Amplifier is tested by sending a signal using the network analyzer through the resonator to the amplifier. The amplified signal can be seen on the screen. The minimum threshold value should be 5V in order for the MEMS logic gate to function. Using PCB technology to minimize the interference of noises is one of the advantages of the new amplifier; in addition, it is low in cost ($25). The hypothetical gain wasn't enough, so higher amplification factor was tested (105) and it satisfied the needs. Moreover, a rectifier device was added and it is capable of converting the AC signal (VP-P = 10V) into DC (+5V). Therefore, MEMS logic gates can be used on a system level and with transistor based logic gates. The eventual goal is to monolithically integrate an amplifier and rectifier into one chip along with the MEMS logic gate in order to build more scalable systems.

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