



Editorial

MEMS Resonant Devices as a Revolutionary Technology

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Resonance, a natural phenomenon, is a fundamental physical property of any object. Resonant devices, such as resonators, filters and sensors, have been widely used in daily life for several years.

Due to advances in micro/nano-manufacturing technology, recent developments of novel MEMS/NEMS (micro/nano-electromechanical systems) resonant devices with high-quality characteristics have shown revolutionary advantages compared to traditional devices. They have become dominant in timing, sensing and other emerging applications, attracting widespread research interest. MEMS resonators have shown significant potential as perfect substitution of crystal resonators for next-generation electronic devices, with high quality, precision and reliability. Companies such as SiTime, Micrel, and Murata are providing game-changing MEMS resonator and oscillator products in the timing market, which is expected to reach a value of USD 802.8 million by 2022 [1]. Great progress has been made in the theory of resonance, including energy-loss mechanisms for the high-quality and nonlinear characteristics of resonators and the optical and quantum resonance effect in nano-resonators [2]. Many novel MEMS/NEMS resonators have been fabricated to achieve high-frequency and high-quality characteristics, with a limit to their theoretical advantages. High-performance MEMS resonant filters and oscillators with ASIC circuits are superior to traditional devices. Numerous new sensing materials and metamaterials have been integrated with resonant sensors for ultra-sensitive detection of target molecules or biomarkers in bio-systems [3]. Great breakthroughs in novel MEMS/NEMS resonant devices are imminent, including multidisciplinary efforts in artificial intelligence network-computing resonant devices, opto-mechanical coupling nano-resonant devices and quantum spin coupled nano-resonant devices, among others. All of these have broad application prospects in future high-precision timing, sensing, AI and quantum computing systems [4,5].

For this Special Issue, authors are invited to submit original research articles and reviews on novel MEMS/NEMS resonant devices, such as resonant timing devices, sensing devices and computing devices, as well as frontier topics regarding resonant computing devices and optical and quantum nano-resonant devices. All aspects of resonator-related topics are welcome for this Special Issue, which aims to provide a comprehensive and innovative discussion platform, supporting future advanced applications of novel resonant devices.

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