Sensing Based on Nanomechanical systems coupled with stochastic resonance

Takahito Ono
(Tohoku University, Graduate School of Engineering, Associate Professor)

【Outline of survey】

This research aims at developing nonlinear mechanical micro/nano-sensors with an ability of signal processing on the basis of stochastic resonance under applying external noise. For this purpose, nonlinear mechanical silicon resonators will be developed, and its binary state with large or small vibration amplitude is used as digital signal for processing. External stimulus to the sensors causes the transition between the binary states, which can be applied to applications for sensing. The transition probability is also influenced by the external stimulus. Mechanical signal processing using the large array of mechanically- or electrically-coupled resonators will be studied. This mechanical circuit can perform logical operation at the sensor level, which reduces the excess load to LSI and realizes smart systems. Signal amplification can be performed by adding noise to the binary state. Developing devices consisted of coupled resonators with ability of advanced signal processing is our objective.

【Expected results】

A kind of sensory organs of creatures is known to use stochastic resonance for signal amplification. In this research, we propose micro-nanomechanical solid state sensors mimic to biological sensory systems. In addition, signal processing ability at the sensor can make the system smart, which reduces the load to LSI and may realize more complex signal processing. A highly-developed sensor system with advanced functions mimic to biological sensory systems is expected to open novel approach to realize sensory systems for robotics and artificial sensory organ.

【References by the principal researcher】

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【Term of project】 FY2008－2012	【Budget allocation】 77,600,000 yen (direct cost)

【Homepage address】 http://www.mems.mech.tohoku.ac.jp/index.html