

Parallel computation using MEMS oscillator-based computing system

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ABSTRACT

In recent years, parallel computing systems such as artificial neural networks (ANNs) have been of great interest. In these systems which emulate the behavior of human brains, the processing is carried out simultaneously. However, it is still a challenging engineering problem to design highly efficient hardware for parallel computing systems. We will study the properties of networks of Microelectromechanical System (MEMS) oscillators to explore their capabilities as parallel computing infrastructure. Furthermore, we simulate the time-variant states of MEMS oscillators network under various initial conditions and performance of certain tasks. Recent theoretical results show that networks of MEMS oscillators have some properties such as phase locking, frequency locking, and synchronization which make the parallel computation possible. We demonstrate how networks of MEMS oscillators can be used for parallel computing in pattern recognition tasks through a series of Jupyter notebooks. The simulation results show that MEMS oscillator networks are able to memorize and recognize multiple patterns as well as perform image convolution with a structure consisting of a multitude of 2-oscillator networks. Hence, MEMS oscillator network is a potential candidate for future embedded computing system to improve computational performance of problems.

KEYWORDS

MEMS oscillator, pattern recognition, parallel computing system