Electronic Sensor for Detection of Particles on Microfluidic Chips (#7107)

A detection system for particles in microfluidic channels

Inventors at Georgia Tech have developed a novel system of parallel detection in multiple microfluidic channels, which relies on code division multiple access (CDMA), a spread spectrum telecommunication technique. In CDMA, users’ signals are transmitted at the same time and within the same frequency band, while multiplexing is achieved by modulating the information in each channel with a unique digital spreading code. The set of CDMA digital spreading codes are designed to be orthogonal to minimize the cross-correlation while maximizing the auto-correlation. The technology has been demonstrated on four microfluidic channels encoded by 7-bit long Gold sequences. The chip has only three electrodes: a positive and a negative electrodes on the opposite sides of each microfluidic channel (ordered to follow their unique digital spreading code) and a reference electrode placed in between the coding fingers, used to generate a bipolar signal. The system has successfully detected the presence of multiple ovarian cancer cells in the channels and could even resolve their timing.

Benefits/Advantages

- Combination of microfluidics technology and CDMA telecommunication principles
- Simultaneous detection of particles, including particles that overlap in time, from a single electrical output
- Scalable electronic design for high-throughput lab-on-a chip applications

Potential Commercial Applications

- Point-of-care testing and for resource limited settings
- Biomedical diagnostics
- Blood testing
- Bio-analytical instrumentation
- Environmental monitoring

Background/Context for This Invention

Detection and quantification of small particles in liquids are of interest in numerous applications, ranging from bio-medicine to environmental monitoring. Coulter counters are widely used to that purpose, since they allow rapid quantification and sizing of particles in microfluidic channels. They use resistive pulse sensing, a technique that detects the electrical resistance change caused by a particle in the liquid it flows through. But high-throughput lab-on-a-chip applications require parallel detection and enumeration, and existing systems interface with large number of electrodes, which limit their scalability.
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For more information about this technology, please visit:
https://industry.gatech.edu/technology/electronic-sensor-detection-particles-microfluidic-chips