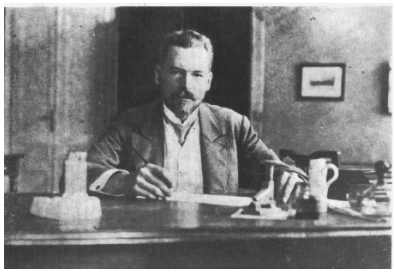

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Negative mobility for controlled mass-based particle separation

Thursday, 6 September 2018 15:00 (3 hours)

Dynamics of the systems at the sub-micro level can reveal astounding effects and may often mislead our intuition. However, since fluctuations play a key role at this scale, unexpected physical phenomena that contradict our everyday experience should not be a surprise. In this study we consider one of the anomalous transport effects, namely the directed transport of the particles in the opposite direction to an external static force applied to the system. Such a behaviour, referred to as negative mobility, was predicted theoretically in 2007 in a system consisting of inertial Brownian particle moving in a one-dimensional periodic symmetric potential [1]. A year later it was confirmed experimentally in the experiment involving determination of current-voltage characteristics of the microwaved-driven Josephson junction [2]. In 2010 negative mobility has been observed for sub-micro colloidal particles [3] and in 2016 for intracellular organelles [4].

In terms of the Brownian motion the following problem is considered: is it possible to use negative mobility in order to mechanically separate a mixture of various particles in a controlled manner? A number of experiments involving negative mobility already report on successful separation of two types of particles with different sizes in a microfluidic devices [3, 4]. However, no investigation on how to isolate particles with desired parameters has been found. We performed a number of numerical simulations in order to reveal conditions that guarantee controlled particles isolation by the means of difference in their mobility. In the mechanism proposed here the distinction between particles is based on their absolute mass, i.e. parameter of the model reflecting the correlation between particle mass, applied potential and friction forces present in the system.

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