LITHUANIAN ENERGY INSTITUTE

ADMISSION TO PHD STUDIES FOR THE YEAR 2024

DOCTORAL RESEARCH TOPIC:

Investigation of microparticles behaviour and flow dynamics in microfluidics applications

RESEARCH FIELD:

Energetics and Power Engineering (T 006)

BRIEF DESCRIPTION OF RESEARCH TOPIC:

Microfluidic devices, encompassing Lab-on-a-chip (LOC), micro-total analytic systems (µTAS), and microelectromechanical systems (MEMS), find applications in various fields. Microfluidics, as an interdisciplinary area, plays a pivotal role in biomedical research, chemistry, medicine, disease diagnostics, the electronics industry, and more. Its significance extends to diagnostics, chemical and biological analyses, food and chemical processing, and environmental assessment. These devices offer several advantages, including high efficiency, low cost, and environmental compatibility.

In the past decade, microfluidic applications based on inertial particle migration and secondary flows have gained popularity for addressing various tasks. Designing effective microfluidic applications involves the purposeful selection of geometrical, flow, and particle physical parameters. The primary objective is to achieve efficient particle separation, trapping, docking, and focusing.

One of the main challenges in microfluidics application design is the precise control of hydrodynamic forces acting on particles. This control, dependent on the flow structure and channel geometrical parameters, allows for the manipulation of both single and large quantities of

particles in the flow. Identifying fundamental regularities that influence hydrodynamic forces related to particles, flow, and channel parameters is crucial. Clarifying these patterns can lead to improved efficiency, increased throughput, and a reduction in faults and errors in microfluidic applications.

The primary objective of this study is to experimentally investigate the behavior of microparticles by controlling flow and geometrical parameters that influence the forces acting on the particles in the flow. To achieve this goal, an analysis of flow rate, channel geometry, flow structure, and microparticle size, shape, and concentration influence on microparticle behavior is essential.

The results obtained from this study will enhance both fundamental and practical knowledge of microparticle behavior in the flow and the dependence of hydrodynamic forces on flow and geometrical parameters. These findings are expected to provide a roadmap for the passive control of flow and particles in the design of microfluidic applications.

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