UNIVERSITY OF ŽILINA

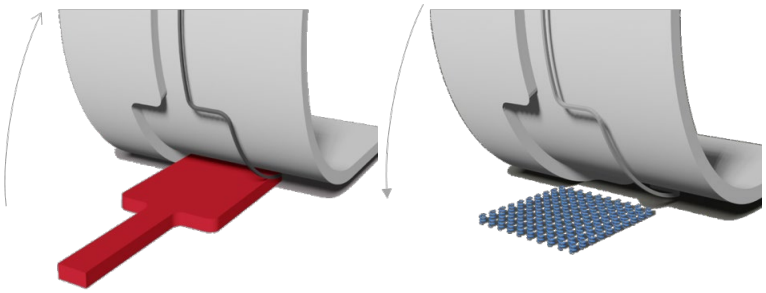
FACULTY OF ELECTRICAL ENGINEERING AND INFORMATION TECHNOLOGY

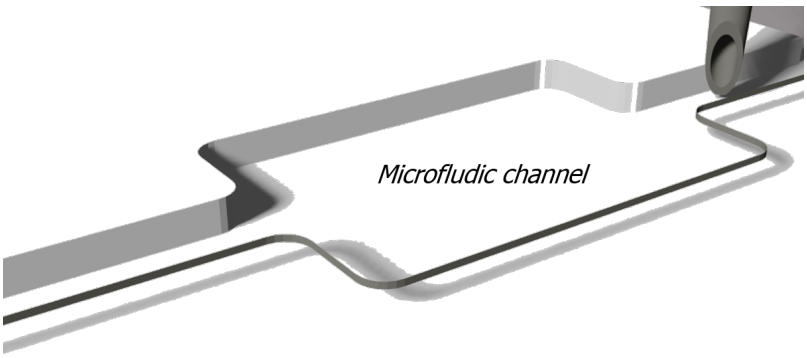
3D printing task

Topic: **„Lab-on-a-chip – Part I – Microfluidic channel“**

Description and goals:

A lab-on-a-chip (LOC) is a miniaturized device that integrates into a single chip which is capable of carrying out separations and detections with high resolution. This miniaturization also offers advantages, like cost efficiency, diagnostic, and sensitivity for analysis such as DNA sequencing and biochemical detection. The simplest arrangement of LOC consists of inlet and outlet parts for analyte delivery into functional part which is crucial part of LOC. According to the function of LOC, different structures can create functional part of LOC.
In recent years, plasmonic structures opened new capabilities in detecting different biomaterials tailoring the structure design. Plasmonic structures are able to recognize chiral activity at the nanoscale, expanding and complementing research in molecular chiral environments. The principle lies in the fact that chiral molecules interact differently with circularly polarized light (CPL), absorbing left- and right-handed circular polarization to different extents. This interaction can be enhanced by coupling chiral molecules with plasmonic nanostructures. Many naturally occurring biomolecules, including amino acids, sugars, and nucleotides, are chiral and often exist in only one of the two possible enantiomeric forms. This highlights the importance of enantiomer detection and separation, as well as the need for stereoselective synthesis. Chiral plasmonic structure is one of the options for LOC device.
The project is separated into two parts. In the first part, a microfluidic channel is created by the first team, while the second part consists of the preparation of functional microstructure, e.g. chiral structure, by the second team. Both teams coordinate activities in order to obtain one LOC device.
In this first part of the project, a microfluidic channel is prepared using direct laser writing technique in combination with polymer embossing.





The following sub tasks will be due:

- Research on LOC and specific microstructures, e.g. chiral
- Defining the functionality and physical requirements
- Creating a 3D model using CAD software (Autodesk Inventor, Blender, SolidWorks, …)
- Selecting appropriate 3D printing methods and materials
- Printing and testing LOC with functional structure, measuring fluidic and optical properties of prepared chip

Responsible
Professor: Prof. Ing. Dušan Pudiš, PhD.

Supervisor: Mgr. Ivana Lettrichová, PhD.
Ing. Peter Gašo, PhD.

Contact: lettrichova@fyzika.uniza.sk
+421 41 513 2320