

# Laser-Driven Microrobots for Microscale Manipulation

Jessica Rutherford<sup>1</sup>, Andriy Sherehiy<sup>2</sup>, Dan Popa<sup>3</sup>

<sup>1</sup>*Saint Louis University*

<sup>2</sup>*University of Louisville*

<sup>3</sup>*University of Louisville*

## **Abstract**

As the concept of micro-factories has developed for the past few decades, there has become a need to address how to transport microscale materials efficiently and reliably from point A to point B. In this study, we propose a new approach to realize the transport of microscopic objects utilizing a silicon microrobot smaller than 1 mm called Serpenbot. Serpenbot is a laser-driven MEMS robot designed to operate in dry environments. Its design consists of 2 serpentine-like actuators in tandem with “legs”, which drive the robot when irradiated by laser light. The propulsion generated in this manner is based on opto-thermal-mechanical coupling. The steering control is realized by selective irradiation of the actuators. Serpenbot’s locomotion is observed with the help of a custom automated system that enables pulse laser irradiation control, tracking of the robot, monitoring and recording its behavior. As a part of our project, we have focused on the Serpenbot’s motion characteristics and their dependence on the laser parameters, which involved driving microrobot at different linear velocities along trajectories of various shapes – circular, rectangular, etc. An analysis of collected data showed that our microrobot has an average velocity of around 54 microns per second, whereas the instantaneous velocity typically ranges from 10~110 microns per second. In the second part of our project, we investigated different methods for transporting microscale objects of different shapes and sizes with the help of Serpenbot.

## **Biography of Presenter (in 12 Pt Ariel Font)**

Jessica Rutherford is a junior mechanical engineering student at Saint Louis University. Where she made the dean’s list for the 2021-2022 academic school year and the fall 2022 semester. She is currently an undergraduate researcher at the University of Louisville’s IMPACT-NG REU.

