Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

Case ID:M20-049L
Published: 5/22/2020

## Inventors

**Hamidreza Marvi**
**Mahdi Ilami**
**Reza James Ahmed**

## Contact

Jovan Heusser
jovan.heusser@skysonginnovations.com

# Novel System for Controlling Ferrofluidic Robots

Less invasive medical operations and procedures benefit patients by providing shorter recovery times, decreased risk of infections and a reduction in a number of complications. The rapid advancement of robotic technologies, such as miniature medical robots, could help realize this goal. However, existing small-scale robots are limited in the functions that they can perform, and advanced dexterity, such as deformation, subdivision, etc., is needed to be able to perform highly complex procedures.

Researchers at Arizona State University have developed a novel system for precisely controlling a bio-inspired, miniature, deformable, ferrofluidic robot. The closed-loop, model-free control system can manipulate both the position and shape of the miniature robot with high dexterity. The ferrofluidic robot is able to shapeshift, move, subdivide, recombine, pass through small channels, engulf particles, induce flow and manipulate objects.

This control system gives ferrofluidic robots the ability to perform complex maneuvers and movements with advanced dexterity, opening up new possibilities for their use in medical and microassembly procedures.

Potential Applications

- Miniature magnetic robots to assist in medical operations and procedures
  - Drug delivery
  - Tumor treatment in difficult to reach locations
  - Sensing/diagnostics
  - Detoxification
- Miniature magnetic robots to assist in microassembly and lab-on-a-chip procedures
  - Removing contaminant particles
  - Transporting reagents/components

- Confining chemical elements/catalysts

Benefits and Advantages

- Closed-loop, model-free control scheme capable of manipulating both the position and shape of the miniature robot with a high level of dexterity
- The control scheme allows the ferrofluidic robot to be separated and recombined, shapeshift, travel in any direction, pass through small channels, engulf particles, induce flow and manipulate objects
- The ferrofluidic robot can be stretched to any intensity up to splitting
- Combined position and shape control of ferrofluidic robots under 1 mm was demonstrated

For more information about the inventor(s) and their research, please see

Dr. Marvi's departmental webpage

Dr. Marvi's laboratory webpage