

# Research Statement

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My research is in the area of mechatronics, robotics, dynamic systems and control. In addition to the area of stochastic systems, computational methods for sensing, estimation, and control problems, with a focus on robotic systems. Within my work I aim to reflect and highlight the applicability of these subjects to a diverse and varied energy domains and fields. To date, my research can be broadly categorized into 4 themes:

- 1) A Novel Hybrid Aerial and Ground Hoverbike: Dynamics and Control.**
- 2) Remote center of motion (RCM) Manipulator for Vitreoretinal Surgery.**
- 3) Design of a 3U Cubesat Structure and its Deploying Mechanism.**
- 4) Dynamics and control of any robotic system.**

## **1) A Novel Hybrid Aerial and Ground Hoverbike: Dynamics and Control**

This project presents a new hybrid Hoverbike for rescue and transportation purposes. It could be used for rescue situations, in terrain areas for landmine detection, in surveying area, in agriculture for sprinkle pesticides instead of human. This project win a special fund from Innovation and Entrepreneurship center at Benha University (IEC). This research has been submitted as a patent with filling no 1007/2020.

## **2) Remote center of motion (RCM) Manipulator for Vitreoretinal Surgery**

This project has given a fund of 150,000 EGP from STDF. It presents design, analysis and implementation of a new Remote Center of Motion mechanism (RCM) compliant manipulator. The proposed manipulator can be integrated with a robotic system in robot-assisted surgery which helps to reduce the imperfections of safety, stiffness, and ergonomics.

## **3) Design of a 3U Cubesat Structure and its Deploying Mechanism**

This research group of students is under my supervision and the purpose is the development of a standard platform architecture of 3U Cube Satellite. This project has given a fund of 75,000 EGP from Academy of Scientific Research and Technology (ASRT)

#### 4) Dynamics and control of any robotic system

This research focuses on developing principles for such highly-dynamic robotics, and work lies at the intersection of three disciplines: mechanical design, controls and machine learning. Control algorithms can be used effectively to modify the natural dynamics of a system and to enhance robustness, but there are obvious reasons why the fundamental mechanical design of a robot is also vital to performance. My aim in integrating these three components (design, control and learning), is to create a multidiscipline research groups under my supervision .

#### **Future Plans**

*As an assistant professor, I plan to tackle my research agenda by establishing a research group with some of the best students that share my enthusiasm in robotics. With my team, I intend to gain insight into significant practical problems and to build robotic systems that sense and act intelligently in the physical world.*