ARAtronics Research Center for Opto-Mechatronics Engineering

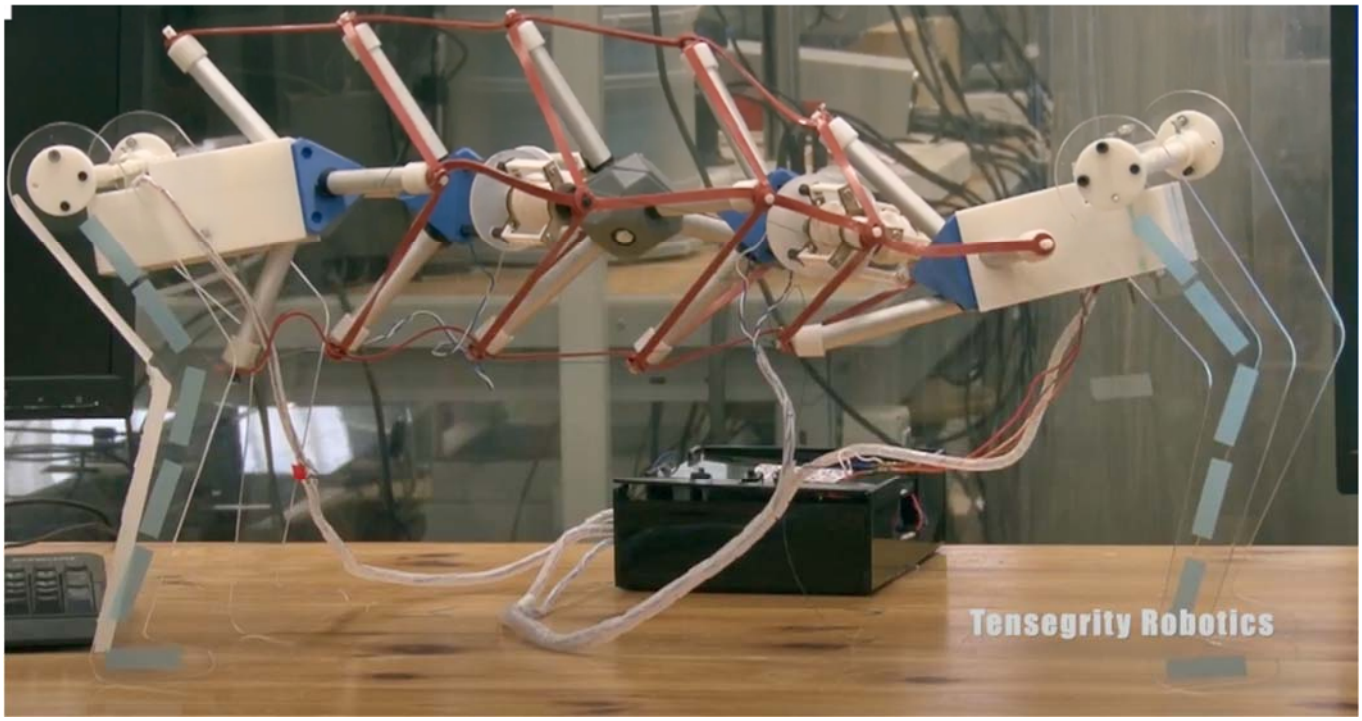
ARAtronics Research Center,
Mechatronics Engineering Department,
Faculty of Engineering and Material Sciences (EMS),
The German University in Cairo (GUC)

Bachelor's Thesis, Term Project

Optimizing the Tension Force on The Flexible Spine Based on Tensegrity Mechanism on the Gait Cycle on the Four Legged Robots

Main Advisor(s): (**Assoc. Prof. Dr. Eng.** Amir Roushdy)
Co-Advisor(s): (**Eng.** Malek Mahmoud, **Eng.** AbdElrahman Ibrahim)

In this project, we present a novel approach for optimizing the tension force on the flexible spine based on a tensegrity mechanism during the gait cycle of a four-legged robot. The proposed optimization method utilizes a combination of model-based and learning-based optimization techniques to achieve efficient and robust optimization of the tension force. The optimization process takes into account the dynamics of the flexible spine modeled using tensegrity theory and uses this information to generate the appropriate tension force. **There is a Master's student from Mechatronics Engineering Department, Senior Researchers from ARAtronics also available to help and advice and The Lab Engineer from ARAtronics, guiding and directing the student with Assoc. Prof. Dr. Eng. Amir Roushdy.**



For more details, please contact:
Assoc. Prof. Dr. Eng. Amir Roushdy, Room: C7.108, E-mail: amir.ali@guc.edu.eg, Web site: www.ARAtronics.com

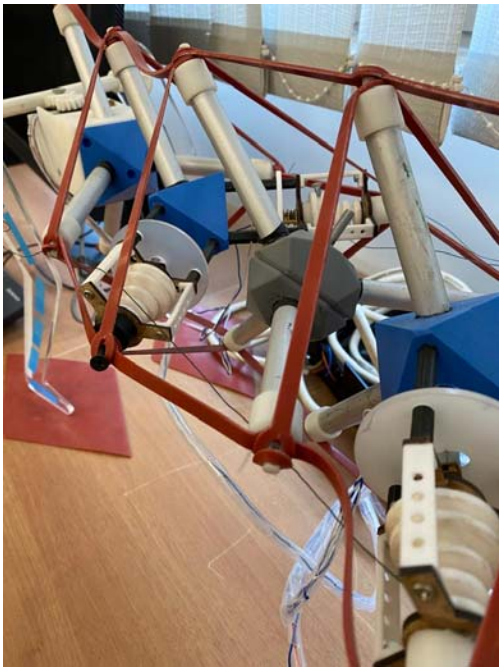


Fig.: The quadruped robot with a tensegrity spine at the ARAtronics Research Center

Project description and objective:

The proposed optimization approach is designed to ensure that the tension force is within the safe range of the tensegrity mechanism and does not damage the structure. The performance of the proposed optimization approach is evaluated through simulations and experiments on a physical robot, showing significant improvement in the efficiency and robustness of the gait cycle. This work highlights the importance of considering the dynamics of the flexible spine in the optimization of the tension force for four-legged robots, and the potential of advanced optimization techniques for improving the performance of these systems.

Research focus of this project:

- Literature review on the project should be studied properly.
- Creating a 3D Model of the model for the project and the hardware.
- Some experiments on the model and control system should be conducted and built properly.
- The outcomes must be documented.

Requirements:

- Passionate to learn more about 3D Printing design, Robotics and control.
- Prior mechatronic design expertise is desired like "SolidWork".

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- Enthusiasm for completing actual practical work with 3D printing staff (design fabrication and construction).
- A method of working that is both structured and self-contained.

General tasks of the project:

- The complete methodology is already available in the ARAtronics Lab, so we will discuss it from the first day to start the automation process for it
- Fabricate the machine/system using 3D printer/CNC machine .
- Assembly all parts of the Robot.
- Changing the working variables and see the effect on the locomotion of the robot.

Other notes:

- A weekly meeting with the advisors will be required for this project, as well as weekly progress updates (***The meeting could be more than once during the week based on your progress and based on your achievements***).
- You should to be in the Lab two days per week (***It could be more than two days based on your progress and based on your achievements***).
- All reports must be prepared in the style of a research paper.
- The outcome of this project will be publish into one of the coming international conferences/journals.

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