Robotics and Autonomous Systems Thesis Defense

Design and Control of a Lizard-inspired Tube Inspector Robot

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Abstract

Tubes and pipelines serve as a major component of several units in power plants and oil, gas and water transmission. These tubes and pipelines undergoes extreme climatic conditions where the temperature and pressure varies which leads to corroding the pipe over time and thereby create stress cracks in them. A smallest crack in these tubes can lead to major health and safety issues, hence regular inspection of these tubes is required. Most power plants prefer using non-destructive testing procedures for such as long-range ultrasonic testing, phased array ultrasonic testing and scanning. These procedures are carried out with the help of crawlers that go inside the pipe or overall the wall which is attached to the pipes. One of the main drawbacks of the current robotic tube inspection robots is that they are designed to inspect straight tubes and they needed to be manually adjusted around the bends in the tube. The main motivation of this project is to create a robotic system that can grab onto a tube and propagate along the length of the tube as well as be able to move onto adjacent tubes and maneuver around flanges and bends in the tube. Most robots used for inspection rely on roller balls and suction based components that can allow the robot to hold onto the curved surface of the tube. These techniques fails when the surface is rough or uneven, which inspired us to look at other friction based solutions. Lizards are known for their agile locomotion as well as their ability to grab on any surface irrespective of the surface texture. The work presented here is focused at the design and control of a lizard inspired tube inspection robot which uses sophisticated gripper pads taking an inspiration from lizard's feet along with it's fabrication using Polydimethylsiloxane(PDMS) and evaluation of it's frictional characteristics.

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