Development and Control of a Wall Climbing Robot based on Vortex Technology

Master Thesis Proposal in Automatic Control

Conceptual design of the LTU-WCR

The research area of Wall-Climbing robots (WCR) has steadily gained interest over the years as a promising approach to remote inspection and maintenance of big and hard to reach spaces [1]. The development of reliable WCRs with Inspection capabilities would significantly cut maintenance costs in areas where manual inspection times are high and the worker security might be compromised. The improved visual feedback and measurement possibilities could improve inspection quality as well as speed up the overall process. A WCR could also operate in environments that are hazardous to humans, such as chemical storage tanks or structures at great heights, hence the continued research on Wall-Climbing Robots for inspection purposes is a key to improve industrial security.

This master thesis will address the increasing need for advanced WCRs, where the participants will undertake the development and control of a novel vortex-based WCR design. The LTU-WCR will possess two main abilities:

    a) Vortex Generation: Attachment on targeted flat and/or curved surfaces with the generation of negative pressure,

    b) Locomotion: Performance of advanced motion patterns via the use Mecanum (Omnidirectional) wheels.

Measurements regarding the generated negative pressure, position, orientation etc. of the LTU-WCR will be acquired via the incorporation and testing of various sensors (Vacuum sensors, IMUs, Stereoscopic/Thermal Cameras, etc.) into the proposed robotic structure.

The development of the wall climbing robot will enable further research on the synthesis and evaluation of path planning algorithms, in order to support the execution of automated inspection sequences on targeted surfaces of alternating curvature.

- No. of Participants: 1 – 2 Students
- The development of the LTU-WCR will require the handling of various mechanical and electronic components (motors, microprocessors, cameras & other sensors etc.)
- The programming of the LTU-WCR will require the use of various software packages (Matlab, ROS, LabVIEW) and various of operating systems (Windows, Linux, Arduino etc.)
- Knowledge in computer-aided-design (CAD) and Rapid Prototyping (3D Printing) will be considered a plus.
- Guidance will be provided by the supervisors on a weekly discussion basis.

Proposal from Georgios Andrikopoulos, Angelica Brusell and George Nikolakopoulos, Control Engineering Group, SRT

Georgios Andrikopoulos, Room A2574, geoand@ltu.se

Angelica Brusell, Room A2563, angelica.brusell@ltu.se

George Nikolakopoulos, Room A2556, geonik@ltu.se

References

[1] A. Brusell, G. Andrikopoulos, G. Nikolakopoulos, "A Survey on Pneumatic Wall-Climbing Robots for Inspection", in *24th Mediterranean Conference on Control and Automation* (MED), 21 – 24 June 2016, Athens, Greece.