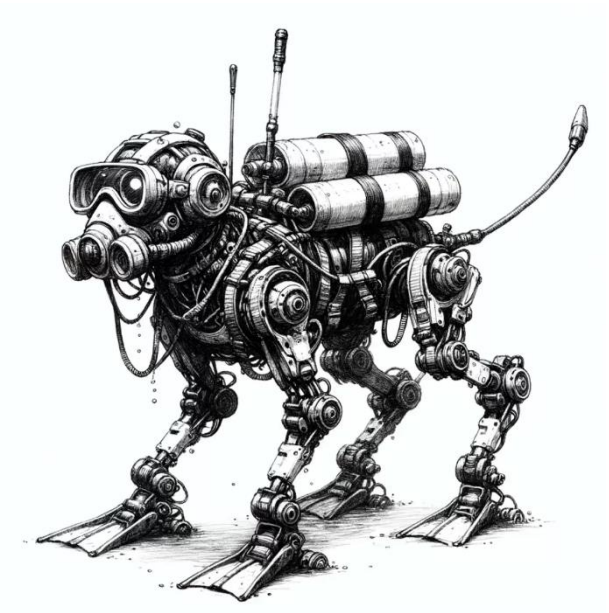
Design, Development and Control of an Underwater Swimming Quadruped

Abstract: Legged robots go swimming! This project aims to develop a quadruped legged robot for underwater operations. The design shall present a host of gaits that allow the system to swim and also walk on the sea floor. Your task is to design the mechatronic solution, realize it in practice and develop control for its baseline leg gaits.



Tasks:

- Study modeling of quadrupedal robot kinematics.
- Study the force and torque generation through control surfaces attached on the end effectors of quadrupeds underwater.
- Design an underwater quadruped system for depths up to 1m (to allow easier manufacturing).
- Design methods for gait control for swimming quadrupeds.
- Realize the designed prototype and implement the control approach.
- Test inside a laboratory pool offering motion capture (for feedback control without need for onboard estimation)

Literature (indicative):

[1] Kashem, S.B.A., Jawed, S., Ahmed, J. and Qidwai, U., 2019. Design and implementation of a quadruped amphibious robot using duck feet. Robotics, 8(3), p.77.

[2] Picardi, G., Chellapurath, M., Iacoponi, S., Stefanni, S., Laschi, C. and Calisti, M., 2020. Bioinspired underwater legged robot for seabed exploration with low environmental disturbance. Science Robotics, 5(42), p.eaaz1012.

[3] Astolfi, A., Picardi, G. and Calisti, M., 2021. Multilegged underwater running with articulated legs. IEEE Transactions on Robotics, 38(3), pp.1841-1855.

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