

Título: DESIGN AND CONTROL OF A TRANSFORMABLE ANTHROPOID ROBOT FOR UNDERWATER WORKS

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Fecha de lectura: 25/10/2016

Mención a doctor europeo: concedido

Programa de doctorado: Programa Oficial de Doctorado en Automática y Robótica

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Descriptor:

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> DISEÑO DE MAQUINAS

> TECNOLOGIA DE LA AUTOMATIZACION

> VEHICULOS SUBMARINOS

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Resumen: The underwater works performed on submerged structures require devices for handling equipment and tools in both offshore and inland applications. Remotely operated vehicles have been used since decades to perform underwater operations with some degree of telepresence, using sensors and actuators. However, when the tasks become complex human immersion is needed. Apart from the health hazards related with pressure, there exists a number of risks associated with operations realized in hostile underwater environments. Moreover, beyond certain depth underwater works are not possible for humans without using machines.

This research work builds on the idea that humanoid robotics can broadly contribute to solve this problem, providing robotic divers for dangerous underwater works. As a proof of concept, a novel underwater humanoid robot named DiverBot is developed along this thesis, focusing on design and control aspects.

Robot design is inspired by the proportions of chimpanzees, and presents the capability to transform between two different functional configurations i.e., anthropoid and vehicle modes. The arms and legs of the underwater robot are driven by hydraulic actuators, while electric thrusters are used for propulsion. A software system is implemented using a real-time controller to manage the sensors and actuators of DiverBot. A static stability analysis is proposed for quadrupedal locomotion in underwater conditions through a screw theory method. The setpoint regulation problem is solved for vehicle configurations by means of a control strategy based on optimal allocation of errors and linear controllers.

The experimental results show a correct performance of the prototype in underwater conditions, opening new horizons to potential applications of DiverBot for increasingly complex missions. In this way, robotic divers could be the next generation of machines for underwater works, and its development will be certainly one of the challenges of applied robotics in the coming years.