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Design and Navigation of Wheeled and Flying Robots for Surveillance and Inspection

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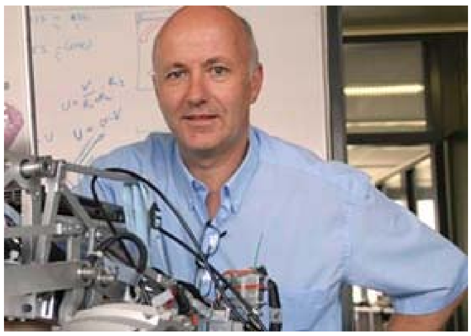
Robots are rapidly evolving from factory work-horses, which are physically bound to their work-cells, to increasingly complex machines capable of performing challenging tasks. One such task is that of surveillance and inspection. It requires robots to operate in unstructured and unpredictable environments. This talk will focus on design and navigation aspects of several robots, both wheeled and flying, that have been built by my research group to address the many open challenges in this highly complex task.

Our strategy has been a multi-pronged one, addressing several complex research issues, from size and energy efficiency to navigation in unstructured environments and the use of flying robots as a means of effectively dealing with such scenarios. This research has led to the development of several robot platforms that exhibit features useful in for operation in hazardous environments. *CRAB* is the most recent addition to the family of exploration rovers that are best adapted for operating in very rough terrain and is currently one of the candidates for the ESA's (European Space Agency) ExoMars mission to Mars, scheduled for 2016. Our Inspection Robots, equipped with magnetic wheels, are capable of entering steam chests or even into the air-gap between rotor and stator of a generator. They allow inspection with minimal disassembly of large installations and thus drastically reducing downtime during servicing of power plants at ALSTOM.

Research in flying robots, which address issues related to flight capability, miniaturization, and energy considerations, has become an integral part of research at our lab, with ever increasing importance; we view these robots as a very effective solution to handle hazardous environments such as areas affected by natural disasters , e.g. earthquakes. With our micro-helicopters projects *muFly* and *sFly,* we approach autonomous flight in cluttered and very narrow indoor environments as well as GPS denied navigation in cities. The goals of these projects are to develop fully autonomous micro-helicopters similar in size and weight to a small bird and to navigate in complex environments with vision only. The *SKY-SAILOR* is a small fixed wing airplane capable of staying in the air indefinitely due to its solar powered generator. It weighs only around 2.5 kg and has a wing span of 3.2 m.

Biographical Sketch



Roland Siegwart is a full professor for autonomous systems at ETH Zurich since July 2006. He has a Diploma in Mechanical Engineering (1983) and PhD in Mechatronics (1989) from ETH Zurich. After his postdoctoral year at Stanford University, he worked as a R&D director at MECOS Traxler AG and as a lecturer and deputy head at the Institute of Robotics, ETH Zürich. In 1996 he was appointed as an associate and later full professor for autonomous microsystems and robots at the Ecole Polytechnique Fédérale de Lausanne (EPFL). At EPFL he was a co-initiator and founding Chairman of Space Center EPFL and Vice Dean of the School of Engineering. In 2005, he held a visiting position at NASA Ames and Stanford University.

Roland Siegwart is a member of the Swiss Academy of Engineering Sciences and the Research Council of the Swiss National Science Foundation He served as the Vice President for Technical Activities (2004/05) and is an AdCom Member (2007-12) of the IEEE Robotics and Automation Society. He has been a coordinator of three European Projects and co-founder of several spin-off companies.

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