

"Soft Robotics" - the new mechatronics?

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Abstract

The fact that the field of mechatronics incorporates systems engineering, mechanical engineering, control engineering, and computer engineering, implies that in designing such systems, one has to decide what aspects of the functionality to put into which component, in particular what should be in the mechanics and what in the control. The term "Soft Robotics" designates a new generation of robots capable of functioning in the real world by capitalizing on "soft" designs at various levels: surface (skin), movement mechanisms (muscles, tendons), and interaction with other agents (smooth, friendly interaction). Industrial robots, by contrast, operate in highly controlled environments with no or very little uncertainty. By "outsourcing" functionality to morphological and material characteristics - e.g. to the elasticity of the muscle-tendon system - the distinction between control and controlled, which is at the heart of manufacturing and control theory, breaks down and entirely new concepts will be required. Just as in mechatronics, the engineer has to determine what should be in the mechanics and what in the control, except that now we have a much wider design space, / the materials, in particular the soft materials, can assume a large variety of functionalities. In this lecture I will argue that the next generation of intelligent machines – robots – will be of the “soft” kind and

I will explore the theoretical and practical implications, whose importance can hardly be over-estimated. I will be showing many examples and case studies from biology and engineering. In particular I will be introducing a soft robotic bartender arm which is part of a new project, ROBOLOUNGE, designed to enable customers to “experience the future” in very close interaction with robots.

Short Bio

Rolf Pfeifer is currently a “Specially Appointed Professor” at Osaka University, Japan, and a visiting professor at the Department of Automation at Shanghai Jiao Tong University, China and a. He is also co-founder of the National Competence Center Robotics, Switzerland.

He has a master’s degree in physics and mathematics and a Ph.D. in computer science (1979) from the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland. From 1987-2014 he was professor of computer science at the University of Zurich and director of the Artificial Intelligence Laboratory. He was a visiting professor and research fellow at the Free University of Brussels, the MIT Artificial Intelligence Laboratory in Cambridge, Mass. (US), the Neurosciences Institute (NSI) in San Diego, the Beijing Open Laboratory for Cognitive Science, the Ludwig-Maximilians-University, Munich, the University of São Paulo, Brasil, and the Sony Computer Science Laboratory in Paris. In 2004 he was elected "21st Century COE Professor, Information Science and Technology, Strategic Core" at the University of Tokyo. In 2009 he was a visiting professor at the Scuola Superiore Sant'Anna in Pisa, and at Shanghai Jiao Tong University in China and was appointed "Fellow of the School of Engineering" at the University of Tokyo. In 2009 he started the “ShanghAI Lectures”, a global, fully interactive videoconference-based series on natural and artificial intelligence that now involves over 50 universities from around the planet.

He is a pioneer of the fields of “embodied intelligence” and “soft robotics” which are now rapidly gaining importance and have already had a decisive impact on the fields of artificial intelligence and robotics. His book “How the body shapes the way we think – a new view of intelligence” has been published in English, Chinese, Japanese, Arabaic, and French. He developed the humanoid robot “Roboy”, which has attracted world-wide media attention, and he is presently pursuing the “ROBOLOUNGE” project, where robots will take care of the well-being of the customers, to be launched in an Asian metropolis in 2017/2018.

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