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Operator-based nonlinear control of micro hand and its application

Soft actuators have been getting increased attention with developing of medical fields, etc. A miniature pneumatic bending rubber actuator is one of the soft actuators. The actuators have the bellows shape and are made of silicone rubbers. Due to the bellows shape, the actuator can do two-way large bending by supplying positive or negative air-pressure. However, to control the actuator and make its model accurately are difficult because the actuator has nonlinearity. Moreover, the actuator should be controlled without sensor because their expected applications are medical fields, especially, in operations. On the other hand, a control system based on operator theory can apply nonlinear systems with uncertainties. The relationship between operator theory and passivity or adaptive control which is an important idea in control engineering has discussed by some researchers. Meanwhile, Support Vector Regression (SVR) has been utilized for classification and regression analysis, where the design parameters are selected by using Particle Swarm Optimization (PSO). Therefore, operator-based control system is discussed. In order to realize sensor less control, PSO-SVR-based moving estimation with Generalized Gaussian Distribution (GGD) kernel is employed. That is, operator-based sensor less adaptive nonlinear control system considering passivity for the actuator and PSO-SVR-based moving estimation with GGD kernel are shown.

Biography

Mingcong Deng is a Professor of Tokyo University of Agriculture and Technology, Japan. He has completed his PhD in Systems Science from Kumamoto University, Japan. He is a Member of SICE, ISCIE, IEICE, JSME, IEEJ and the IEEE(SM). He has his specialization in three complementary areas; operator-based nonlinear fault detection and fault tolerant control system design; system design on thermoelectric conversion elements and applications on smart material actuators. He has over 460 publications including 158 journal papers, 15 books (or chapters), in peer reviewed journals including *IEEE Transactions*, IEEE Press (for books) and other top tier outlets. He was serving as a Chief Editor for *International Journal of Advanced Mechatronic Systems, The Global Journal of Technology and Optimization* and is an Associate Editor of six international journals. He is a Co-Chair of Agricultural Robotics and Automation Technical Committee, IEEE Robotics and Automation Society; also a Chair of the Environmental Sensing, Networking and Decision Making Technical Committee, IEEE SMC Society.

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