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An International Journal

Volume 44, 2016 - Issue 1-2: MUSME 2014

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# Structure-control design of a mechatronic system with parallelogram mechanism using an estimation of distribution algorithm

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Pages 58-71 | Received 26 Mar 2015, Accepted 26 Mar 2015, Published online: 06 Apr 2016

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Mechanics Based Design of Structures and Machines  
Published online: 6 Apr 2016

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## ABSTRACT

In this paper, a structure-control design methodology for simultaneously optimizing both mechanical structure and control of a parallelogram linkage robot is proposed. It takes into account the dynamical model and the mechanical parameters for the optimization process along with the controller. Thus, proportional-integral-derivative (PID) control and geometric variables are optimized in a simultaneously way. Through the concurrent procedure an optimal combination of the robot structure and controller gains is obtained. The global optimization problem is tackled by using an estimation of distribution algorithm (EDA) based on the Boltzmann distribution. The EDA seeks for the global optimum by estimating and sampling a probability distribution. The proposed methodology is verified through simulation experiments and applied to the design process of a parallelogram linkage system. The results obtained in experiments show the effectiveness of the proposal. This approach is generic and could be applied to other mechanisms in similar way when for concurrent process both kinematic and dynamic models are available along with the controller. In particular, the results are promising when the optimization parameters are uncorrelated, namely control and mechanical parameters.

### KEYWORDS:

[Concurrent design](#) [estimation of distribution algorithms](#) [optimization](#) [parallelogram linkage](#)

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