

## Advanced Mechatronic Design of Robot Manipulator Using Hardware-In-The-Loop Simulation

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**Abstract :** This paper discusses concurrent engineering of robot manipulators, based on the Holistic Concurrent Design (HCD) methodology and by using a hardware-in-the-loop simulation platform. The methodology allows for considering numerous design variables with different natures concurrently. It redefines the ultimate goal of design based on the notion of satisfaction, resulting in the simplification of the multi-objective constrained optimization process. It also formalizes the effect of designer's subjective attitude in the process. To enhance modeling efficiency for both computation and accuracy, a hardware-in-the-loop simulation platform is used, which involves physical joint modules and the control unit in addition to the software modules. This platform is implemented in the HCD design architecture to reliably evaluate the design attributes and performance super criterion during the design process. The resulting overall architecture is applied to redesigning kinematic, dynamic and control parameters of an industrial robot manipulator.

**Keywords :** concurrent engineering, hardware-in-the-loop simulation, robot manipulator, multidisciplinary systems, mechatronics

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