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Parameter identification of the Hamiltonian dynamic model of a robot

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Abstract: Recent studies suggest that the use of the Hamiltonian formalism for the description of multibody system behavior may significantly increase the efficiency of modelling and simulation. Parametric identification is of crucial importance when high-fidelity models are required. In this work, the methods of identification, applicable to the Hamiltonian models, are developed. Standard identification methods used in robotics consist of a few steps. First, the dynamic model is written in form of a regressor matrix (dependent on the joint positions, velocities and accelerations) multiplied by the vector of inertial parameters. Second, a sufficiently exciting trajectory is derived. Third, the joint torques and positions are measured while the robot is tracking the trajectory. Fourth, the dynamic parameters are estimated using the least-squares method. The fifth step consists of validation of the model. An application of the standard method to the Hamiltonian framework requires some extensions due to the fact that momenta measurements are not directly available. In this work we present a preliminary investigation on parameter identification procedure. A mathematical model of a system expressed in terms of positions and conjugate momenta is used to formulate the key relations between identified parameters and output measurements. The feasibility study is demonstrated in the work. A general problem of parameter identification is brought to the analysis of a sample test case. Acknowledgements. This work has been supported by the National Science Centre grant 2018/29/B/ST8/00374.

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