Study of Energy Optimal and Near-optimal Control of a.c. Drives with Constant, Linear and Quadratic Frictions

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Abstract - Design and verification of two energy saving position control strategies for a.c. drives employing induction or permanent magnet synchronous motors including a study of their energy expenses and efficiency is the main contribution of this paper. It's supposed that load torque consists of combined constant, linear and quadratic components as a function of rotor speed. For evaluation of energy demands the energy optimal control strategy based on mechanical and electrical losses minimization is compared with the energy near-optimal one based on symmetrical trapezoidal speed-profile for pre-planned rest-to-rest position manoeuver. Both control strategies respect prescribed maneuver time and have defined acceleration profile to achieve the position set-point. Overall control system consisting of energy saving profile generator, pre-compensator and position control system respects principles of vector control and is capable of precise tracking of prescribed state-variables. Energy demands of both control strategies are verified and compared via simulations and preliminary experiments results of which confirmed possibility to achieve substantial energy savings.