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18. abstract The goal of this work was the development of practical AI-based algorithms and system models that can be used for the commissioning and operation of unknown isotropic and anisotropic synchronous machines. The AI-based algorithms and system models offer the possibility of use for offline operation (machine not in operation; at standstill) as well as online (in operation). These techniques aim to optimize operational behavior, such as the dynamics of the controllers and the energy efficiency of the machine, as well as the accuracy of sensorless control. Since modern synchronous machines exhibit nonlinear magnetic behavior in practice, AI-based machine models for isotropic and anisotropic synchronous machines have been developed that can account for nonlinear saturation behavior, cross-coupling, and subharmonics in sensorless control. Additionally, practical models have been created to consider the nonlinear and parasitic effects of the inverter, depending on several input variables such as current, voltage, temperature, and switching frequency. These models can be optimized during an offline commissioning process through identification algorithms. In the next step, it is possible to optimize these models during ongoing operation (online) using AI techniques to account for factors like temperature behavior and load conditions. Based on the AI models, optimization of energy efficiency and dynamics can be performed during operation. To evaluate the robustness and test the practical applicability, different motor technologies have been tested on a test bench under various load conditions.	
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