Design of EV Steering Unit Using AI Based on Estimate and Control Model

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Abstract : Electric power steering (EPS), which is commonly used in electric vehicles recently, is an electric-driven steering device for vehicles. Compared to hydraulic systems, EPS offers advantages such as simple system components, easy maintenance, and improved steering performance. However, because the EPS system is a nonlinear model, difficult problems arise in controller design. To address these, various machine learning and artificial intelligence approaches, notably artificial neural networks (ANN), have been applied. ANN can effectively determine relationships between inputs and outputs in a data-driven manner. This research explores two main areas: designing an EPS identifier using an ANN-based backpropagation (BP) algorithm and enhancing the EPS system controller with an ANN-based Levenberg-Marquardt (LM) algorithm. The proposed ANN-based BP algorithm shows superior performance and accuracy compared to linear transfer function estimators, while the LM algorithm offers better input angle reference tracking and faster response times than traditional PID controllers. Overall, the proposed ANN methods demonstrate significant promise in improving EPS system performance.