World Academy of Science, Engineering and Technology
International Journal of Electrical and Computer Engineering
Vol:18, No:07, 2024

Experimental Validation of a Mathematical Model for Sizing End-of-Production-Line Test Benches for Electric Motors of Electric Vehicle

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Abstract : A mathematical framework has been designed to enhance the configuration of an end-of-production-line (EOL) test bench. This system can be used to assess the performance of electric motors or axles intended for electric vehicles. The model has been developed to predict the behaviour of EOL test benches and electric motors/axles under various boundary conditions, eliminating the need for extensive physical testing and reducing the corresponding power consumption. The suggested model is versatile, capable of being utilized across various types of electric motors or axles, and adaptable to accommodate varying power ratings of electric motors or axles. The maximum performance to be guaranteed by the EMs according to the car maker's specifications are taken as inputs in the model. Then, the required performance of each main EOL test bench component is calculated, and the corresponding systems available on the market are selected based on manufacturers' catalogues. In this study, an EOL test bench has been designed according to the proposed model outputs for testing a low-power (about 22 kW) electric axle. The performance of the designed EOL test bench has been measured and used to validate the proposed model and assess both the consistency of the constraints as well as the accuracy of predictions in terms of electric demands. The comparison between experimental and predicted data exhibited a reasonable agreement, allowing to demonstrate that, despite some discrepancies, the model gives an accurate representation of the EOL test benches' performance.

Keywords : electric motors, electric vehicles, end-of-production-line test bench, mathematical model, field tests
Conference Title : ICEMDS 2024 : International Conference on Electric Machines and Drive Systems
Conference Location : Vienna, Austria
Conference Dates : July 29-30, 2024