Design and implementation of flexible automated production test systems for ennos AG

An automated production test system is developed during this thesis for ennos AG, a solar water pump manufacturing company. As ennos transitioned successfully from a small spin-off to a well-known company in its market with consistent growth in production volume, the need for a new and more sophisticated production test system emerged. Since the product portfolio has also expanded, the new tester must be flexible enough to test different products with little adaptation.

Motivation

 Automated testing in production offers several advantages over manual testing. Firstly, it ensures consistent and reliable test results, meeting the companies quality standards. Secondly, it minimizes the risk of human error and ensures a safe testing process. Lastly, it reduces process time, enabling faster production cycles and increased efficiency.

Goal

The aim of this thesis is to address the challenges associated with the existing semi-automated testers, which still require manual handling of data, files, and mechanical parts. This manual intervention poses risks to consistency, safety, and process time.
The thesis focuses on the design and implementation of an automated production test system comprising two test benches: one for electric motor and electronics testing, and the other for the final assembly of the solar water pump.

Implementation

Existing motor and pump test benches are extended and modified to fully functional production testers. For this purpose, measurement hardware, power supplies, human interface devices, data storages, as well as various mechanical components were installed.

A custom mechanical quick lock system for easy motor handling was developed, manufactured, and added to the motor test bench. An open-source environment called MUSCLE connects, visualizes, and controls all the hardware components and test modes. The test stands are programmed, so that the operator remotely steers the test benches through the dedicated wifi network. Also the data processing and file handling is fully automated, result reports are automatically generated, and stored online in a dedicated database.

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Result

The developed automated production test system has the potential to significantly enhance the production test process. This can lead either to shorter production time, or to a better test coverage of the production volume, which ultimately leads to enhanced product quality, and increased customer satisfaction through less warranty cases. On the motor test bench, several production test steps are combined in one automated device, which greatly facilitates the test handling, and reduces process time. Total test time was reduced by 65% for the motor tests, and 70% for the pump assembly test, which is a significant improvement in both cases. A great benefit of the test benches is also the reduction of manual intervention during tests, and automated data handling.

Motor test bench, equipped with a ennos slp2 0.5Hp motor.
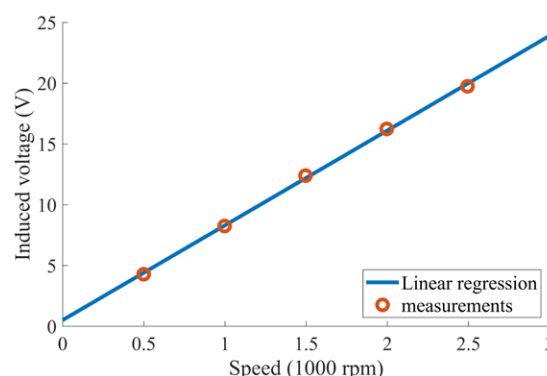
Back-EMF test result of the ennos slp2 0.5Hp motor as it is displayed on the MUSCLE user interface.