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Abstract
The goal of this study is to investigate the design and measurement procedures of the solar cells system on a solar car in order to reduce the power loss and thus achieve the maximum power output of solar cells. Based on the development process of the solar car “Phoenix II”, rational and efficient procedures for measuring IV-curves, evaluating the efficiency of solar modules, and the monitoring of output power are established.
This study includes two main parts. The first part is to design a solar cell system of the solar car and to test its exact efficiency. We investigated factors which might affect the output efficiency, including the features of solar cells, working parameters of Maximum Power Point Tracking (MPPT), the design and arrangement of PV-modules as well as arrays, the weather, and other possible factors. The second part is to conduct field tests on the cell system of the solar car and to verify our design and parameters setting with the practical data obtained from “Phoenix II” during the 3000km cross-country race in 2007 World Solar Challenge in Australia.
To understand the entire working efficiency, we developed LabviewU+AE programs by ourselves, combining various data acquisition modules, ammeters and an e-load to acquire the voltage and current parameters of solar cells, MPPT, PV-modules or a solar cell system. Finally, we used the concepts of reference cells to estimate the relation between the output power of the solar car and the weather condition.
The LabviewU+AE programs, measurement devices and fabricating specifications which were developed and established in this study can be applied on further studies and developments of other solar energy systems.
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