SMART SENSING SYSTEM FOR ENHANCEING THE RELIABILITY OF POWER ELECTRONIC DEVICES USED IN WIND TURBINES

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Abstract: Reliability of modern power systems, in particular those use wind and solar energies, is affected by the relatively short lifetime of the associated power electronic converters (PECs). Thermal stress has been identified as one of the commonest causes for failures in PECs. However, existing thermal monitoring systems are expensive, bulky and with no intelligent capabilities, which limit their full acceptance as monitoring and control tools in operational power plants. This work presents autonomous and inexpensive microcontroller-based system for monitoring and predicting thermal behaviour of switching devices used in PECs. System's inputs are non-intrusively measured voltages and currents drawn by those devices while in operation. The developed system also determines lifetime consumption and has the ability to communicate with external monitoring and control systems e.g. supervisory, control and data acquisition (SCADA) platforms. The performance of the developed system was critically assessed and compared with high-resolution thermal imaging camera. Good agreement between both systems was achieved and the inexpensive developed system was found to have an accuracy of 95%.

Index terms*: Autonomous sensor; lifetime consumption analysis; online rainflow algorithm; dSPACE, finite element, IGBT temperature.*