Practical Papers, Articles and Application Notes

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Arcing faults, if not detected early, can lead to electrical fires. An Arc Fault Detection Device (AFDD) aims to detect arcing faults that cannot be detected by circuit breakers or residual current devices. AFDD is an active electronic device that measures low and high frequency characteristics of the current passing through it. AFDD can be a potential source and victim of EMI, especially in a military electromagnetic environment, where low emission levels and high immunity levels are necessary. Janne P. Pulkkinen from Finnish Defence Forces, Finland, discusses the EMC requirements of AFDD in the first paper, "Commercial Arc Fault Detection Devices in Military Electromagnetic Environment".

The second paper, "Antenna Characteristics over Perfect Ground", is contributed by Valentino Trainotti from the University of Buenos Aires, Argentina. He goes through a very detailed verification of a Friis equation between a transmitting antenna and a receiving antenna over a perfect ground that fulfils the natural energy conservation law. The radio link examples given in the paper allow the readers to understand the antenna characteristics over perfect ground without complicated calculations.

David Weston from EMC Consulting Inc., Ontario, authored the third and last paper "Analysis of Lightning Strike to an Imbedded Electronic Enclosure based on a Scale Model Test Setup". He shows that even with the lack of a large lightning test facility, one can still use a scale model test setup to investigate the effects of lightning to electronic equipment imbedded into the fuselage of a plane. The results of the analysis provide insight of potential weakness of the electronics equipment so that the necessary protection circuits can be designed and installed.

This will be the last issue of the EMC Magazine in 2018. It has been a wonderful year with a number of new authors contributing excellent practical EMC papers. If you have good EMC design case studies and practices to share with our readers, feel free to reach me at ekysee@ntu.edu.sg. Let me take this opportunity to wish you and your family a Happy New Year.

Commercial Arc Fault Detection Devices in Military Electromagnetic Environment

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Abstract—Arc fault detection device (AFDD) is the latest protection device for low voltage circuits. It is used to detect arcing faults that cannot be detected by circuit breakers or residual current devices. Arcing faults are one of the main causes for electrical fires. Arc fault detection device is an active electronic device which operation is typically based on measurement of low and high frequency characteristics of the current passing through. Based on measured current characteristics and the knowledge of the arcing unique deviations in current, arc fault detection device detects possible arcing and disconnects the protected circuit. Arc fault detection device as an active electronic device is a potential source and victim of electromagnetic interference. Electromagnetic compatibility requirements are especially very demanding in military applications where low emission levels and high immunity levels are required. This article presents test results from electromagnetic compatibility testing of five different commercial arc fault detection devices against military standard requirements and analyses the suitability of the arc fault detection devices in military electromagnetic environment.

Index Terms—Arc-fault circuit interrupter (AFCI), Arc fault detection device (AFDD), Electromagnetic compatibility (EMC), Electromagnetic interference (EMI)

I. Introduction

Arc fault detection device (AFDD) is a device that is used in 230 V 50 Hz single phase circuits. Requirements for AFDDs are defined in IEC 62606 standard [1]. The corresponding protection device for 120 V 60 Hz single phase circuits is the arc-fault circuit interrupter (AFCI) which has longer history in the U.S. and it is based on requirements of UL 1699 standard [2].

Typically AFDD is a combination of one module width arc fault detection unit and circuit breaker or residual current device. In some products all of these three protection devices are combined as one device to give protection against different parallel and serial faults.

The operation of AFDD is based on measurement of AC current characteristics and in some applications voltage characteristics. As the arcing causes unique and detectable deviations to AC current and voltage, it is possible to protect circuits against fire with this sophisticated device. It is presumable that AFDD manufacturers use different algorithms and indicators in arc detection and the development is still going on. Comprehensive descriptions of