Application of Modern Microprocessor in Power Conversion Systems: A Practical Approach for Multiphase Drives

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Abstract

Fast modern microprocessors have quickly become a cornerstone of high performance electrical drives, where power electronic conversion systems have heavy online computation burdens and must be controlled using complex control algorithms. Digital Signal Processors have become powerful microprocessors to shape engineering problems in the last few decades thanks to their introduction in 1982 by Texas Instruments. The multiphase machine field, which has been recognized in recent times as an attractive electrical drive due to its usefulness in traction or more-electric aircraft applications and in wind power generation systems, represents a particularly interesting case example to see the ability of modern Digital Signal Processors for the implementation of complex and heavy time consuming control algorithms because their complexity notably increases in relation with conventional three-phase drives. This paper makes a revision of the necessities of a high-performance multiphase drive from the implementation in modern Digital Signal Processors’ perspective. One of the most powerful Texas Instruments’ Digital Signal Processor (TMS320F28335) is used, and specific control algorithms, electronic circuits and acquisition processing methods are designed, implemented and analyzed to show its interest in the development of a high-performance multiphase drive.

Keywords: Digital signal processing, Digital signal processors, Multiphase electrical, Drives, Field oriented control, Predictive current control techniques.