

Tutorial 1 - Multi-Physics Analysis of Adjustable Speed Motor Drives



Dr. Babak Fahimi received his B.S. and M.S. degrees in Electrical Engineering with the highest distinction from the University of Tehran, Iran in 1991 and 1993 respectively. He earned his PhD in Electrical Engineering from Texas A&M University in 1999. Dr. Fahimi has been the recipient of DAAD scholarship (1993-1995), IEEE R.M. Bass Power Electronics Young Investigator Award (2003), SAE Ralph Teetor Educational award (2008), Fulbright scholarship in 2010, and IEEE Cyril Veinott electromechanical energy conversion award in 2015. Dr. Fahimi has co-authored 300 (85 Journal and 215 peer reviewed conference papers) scientific articles, 15 book chapters, and several technical reports in the general area of adjustable speed motor drives and power electronics. He holds 17 US patents and has 6 more pending. Dr. Fahimi has served IEEE in various capacities including chairing of the IEEE Vehicle Power and Propulsion Conference (2007), chairing of the IEEE International future energy challenge competition (2009), chairing the electric machines committee in IEEE-IES (2007-2009), chairing the 2010 IEEE Applied Power Electronics Conference and Expo, and chairing of 2014 IEEE Industrial Electronics Annual Meeting (IECON). Dr. Fahimi is/has been an associate editor of the IEEE Transactions on Industrial Electronics, IEEE Transactions on Energy Conversion, IEEE Transactions on Vehicular Technology, and IEEE Transactions on Power Electronics. Dr. Fahimi has supervised 18 PhD (Four tenured/tenure track professors and the other 14 in industry) and 16 M.S. students. He is a Fellow of IEEE for his contributions to modeling and analysis of adjustable speed ac motor drives.

MULTI-PHYSICS ANALYSIS OF ADJUSTABLE SPEED MOTOR DRIVES

Adjustable speed motor drives exhibit electromagnetic, structural and thermal phenomenon which can interactively affect the performance of the drive system in terms of its efficiency, acoustic noise, torque density, and safety. These systems contain a physical interface between the power electronic circuit and the terminals of the electric machine. It is a necessity to predict the performance of the drive system under normal and transient conditions. This tutorial will provide an insightful and enabling understanding of the interrelated multi-physics phenomena which includes, electromagnetic, fluid dynamics, structural, thermal, and physical interface with power electronics drivers. Examples from induction, permanent magnet synchronous machines, and switched reluctance machines will be provided to explain the impact of the multi-physics analysis in the context of real world applications. The contents of this 3 hours tutorial are selected such that practicing engineers and graduate students as well as research scientists can benefit from.