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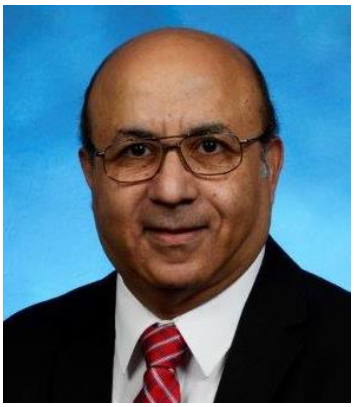

Dr. Alaa El-Sharkawy,

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Keynote title: Computer Simulations for Development of Electric Vehicles Thermal Management Systems

Bio

Dr. Alaa El-Sharkawy, is currently a global manager and technical fellow at FIAT-Chrysler Automobiles (FCA) in Michigan, USA. He earned his B.Sc. in Chemical engineering from Alexandria University, Egypt, and MSc. and PhD. degrees in Chemical Engineering from Wayne State University (Michigan, USA) in 1990. Dr. El-Sharkawy is also a certified professional engineer in the state of Michigan and holds DFSS black belt certificate. He worked for EDS/General Motors in thermal simulation and vehicle thermal management from 1988 to 1999. He received the "Special Achievement Award" from the GM VP for R&D in recognition of his achievement in the development of computer simulation tools for automotive thermal systems. Meanwhile, Dr. El-Sharkawy has been working at Wayne State University (from 1990 – 2005) as an adjunct faculty member in the Chemical Engineering department where he received the "Excellence in Teaching Award". He joined FCA in 1999 where he became responsible for the development of thermal management process and analytical tools. Dr. El-Sharkawy developed a state-of-the-art simulation tool to predict automotive component life and performance which includes computer simulation, automotive test data, material science, traffic density and climatic conditions. He later developed a totally virtual simulation system to predict vehicle thermal performance. In addition, he developed and taught 6 engineering training classes and offered world-wide training to over 4000 FCA engineers. He received a certificate of appreciation "In recognition of his exceptional delivery of technical training to FCA engineers". He was awarded the Walter P. Chrysler technical fellow position in recognition of his technical contributions. Dr. El-Sharkawy is an active member of the Society of Automotive Engineers (SAE) where he chairs several sessions for thermal management and robust design. He also participated in the UN TOKTEN (Transfer of Knowledge Through Expatriate Nationals) program where he trained several institutions in Egypt

on the application of simulation tools in environmental and industrial applications. Dr. El-Sharkawy has published and presented over 50 technical papers in the areas of computer simulations, thermal management, DFSS and sensitivity analysis. He was also a keynote speaker for several technical conferences in the USA, China, and Egypt.

Computer Simulations for Development of Electric Vehicles Thermal Management Systems

Abstract:

Production of electric vehicles has been steadily increasing in recent years and is expected to witness a significant growth in near future. Lithium-Ion batteries are currently the preferred choice for energy storage due to their high energy density. Development of effective thermal management system is critical for the control of lithium-ion battery temperatures to extend battery life, maintain vehicle performance, and enhance battery and vehicle safety. During early stages of vehicle development, computer simulations are applied to predict any thermal issues that may affect the high voltage battery and vehicle performance. In this presentation, the development and application of extensive computer simulation process is presented. A transient thermal analysis model is developed where the effect of driving and soak conditions on battery temperature and performance are analyzed in a 3-D model. The analysis is coupled with customer duty cycle which includes typical city traffic, highway, and grade driving conditions. Battery transient temperature during driving conditions is analyzed to include effect of internal heat generation, external convection, and radiation. Therefore, the battery thermal profile throughout the year is developed. A thermal degradation model is applied to estimate the extent of thermal degradation and the remaining battery useful life for various geographic locations of hot ambient weather conditions.