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High level modelling and verification of in-cylinder diagnostics using a dual signal plasma igniter

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To become a viable solution, next generation ignition systems must utilize new strategies to provide significant environmental and economic benefits. Continuing to build on current ignition schemes using manipulations in timing, modified fuel injection methods, or minor physical design modifications will not be satisfactory. Next generation systems must include completely unique methods as compared to current spark plug systems. One such solution being developed is the Coaxial Cavity Resonator Ignition System (CCRIS), a new approach to igniting fuel air mixtures, dramatically reducing energy consumption. At the core of this ignition system is the Quarter Wave Coaxial Cavity Resonator (QWCCR), a high-power microwave transformer capable of creating a low temperature plasma corona for the ignition of a variety of fuel mixtures. What is also missing from these next generation systems is an equally novel method for on-board diagnostics. This microwave resonator technology can be used as both an ignition device, because of its ability to step up voltage and form coronal plasma, and an in-cylinder sensing device, because of its inherent resonance structure. High level modelling and verification has been performed to show how a dual signal plasma igniter can be used to determine resonance characteristics, in-cylinder density, compression ratio, crank shaft position, and misfire during the combustion process on a cycle-by-cycle basis.

Biography

Andrew D Lowery has received degrees of PhD (2012), MS in Mechanical Engineering (2006), BS in Computer and Electrical Engineering (2004) from West Virginia University. Currently, he is the Lead Scientist at Plasma Igniter, LLC. His research interest is in the areas of design and controls, electromagnetics, and engineering education, resulted in peer reviewed publications, including 19 conference proceedings and 10 articles and bound papers. He is a member of the Institute for Electrical and Electronics Engineers, Society of Automotive Engineers, and Sigma Xi, The Scientific Research Society.

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