

Advanced Ignition Strategies for Clean and Efficient Combustion

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Abstract

New ignition strategies are realized to burn the lean and diluted fuel-air mixtures, promising clean and efficient combustion in future automotive engines. Because strong turbulence needs to be introduced to speed up the otherwise weak flame propagation, a stronger ignition source is imperative to secure the flame kernel formation on time; and to prevent the early flame from being blown off on demand. Future engines also need to burn mixtures of high density, that require much elevated spark discharging voltage and energy. The burning of various renewable fuels further escalates the challenges that make the conventional ignition techniques inadequate to avoid misfire. Under such circumstances, to succeed ignition and fast burning, new strategies are developed with multi-core, multi-coil, boosted current, capacitor current, and plasma expansion controls. Under each configuration, the plasma current can be modulated adaptively under field-programmable gate array control. The new ignition techniques are also suitable to improve combustion in stationary, marine, and aviation engines, irrespective of using renewable or sustainable fuels.