

PULSED, SUPERSONIC FUEL JETS - THEIR CHARACTERISTICS AND POTENTIAL FOR IMPROVED DIESEL ENGINE INJECTION.

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ABSTRACT. High pressure fuel injection has provided considerable benefits for diesel engines, substantially reducing smoke levels while increasing efficiency. Current maximum pressures provide jets that are at less than the sonic velocity of the compressed air in the cylinders at injection. It has been postulated that a further increase into the supersonic range may benefit the combustion process due to increased aerodynamic atomisation and the presence of jet bow shock waves that provide higher temperatures around the fuel. Pulsed, supersonic injection may also be beneficial for scramjet engines. The current program is examining pulsed, supersonic jets from a fundamental viewpoint both experimentally and numerically. Shock wave structures have been viewed for jets ranging from 600 to 2,400 m/s, velocity attenuation and penetration distance measured, different nozzle profiles examined and autoignition experiments carried out. Inside the nozzle sac, numerical simulation using the Autodyne code has been used to support an analytic approach while within the spray, the Fluent code has been applied. Although the modelling is extremely complex, global comparisons show good agreement with experiment. Hence, information on the mixing zone can be inferred. While the benefits of supersonic fuel jets have not yet been defined, it appears that some earlier claims regarding autoignition at atmospheric conditions were optimistic but that increased evaporation and mixing are probable. The higher jet velocities are likely to mean that wall interactions are increased and hence matching such injectors to combustion chamber size and airflow patterns will be important.