講演番号 | 151

文献番号 | 20225151

Atomization Process in Multi-hole Nozzle Spray for Port Fuel Injection (Fourth Report)

- Proposal of Sheet Breakup Model for Numerical Simulation -

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KEY WORDS: Heat engine, Spark ignition engine, Fuel spray, CFD modeling, Atomization, Sheet breakup (A1)

CFD (Computational Fluid Dynamics) simulations are widely applied in automotive engine research and development. Spray breakup models significantly affect the liquid film formation on the intakeport wall impingement and mixture formation. Some breakup models are proposed for diesel spray in previous studies, and TAB model and KHRT model are famous. However, there is no model for the atomization process under port fuel injection conditions with the plate-type multi-hole nozzles which have great atomization characteristics. The purpose of this study is to investigate the spray atomization process and predict the breakup process in multi-hole nozzle spray for port fuel injection. In previous studies, the authors have experimentally investigated the liquid sheet breakup process and droplet behavior of fuel sprays under port fuel injection conditions, and have modeled the droplet generation process based on the liquid sheet breakup theory.In this study, the model analysis of the liquid sheet breakup process based on the phenomenological theory in the previous paper is improved, and the sub-model of the spray breakup process in the numerical analysis is developed. In this report, liquid sheet breakup model was modified and simulated the spray atomization in the numerical analysis.

We consider the edge contraction of the ligament in addition to the modeling of droplet genetration as shown in Figure 1. Liquid ligament has a edge contraction due to surface tension, resulting in the presence of rounded areas. Therefore, droplets generated at the ligament edge are bigger than normal droplets. In this model, droplet diameter distribution is modified to simulate this phenomena. The model can simulate spray formation and its atomization characteristics.

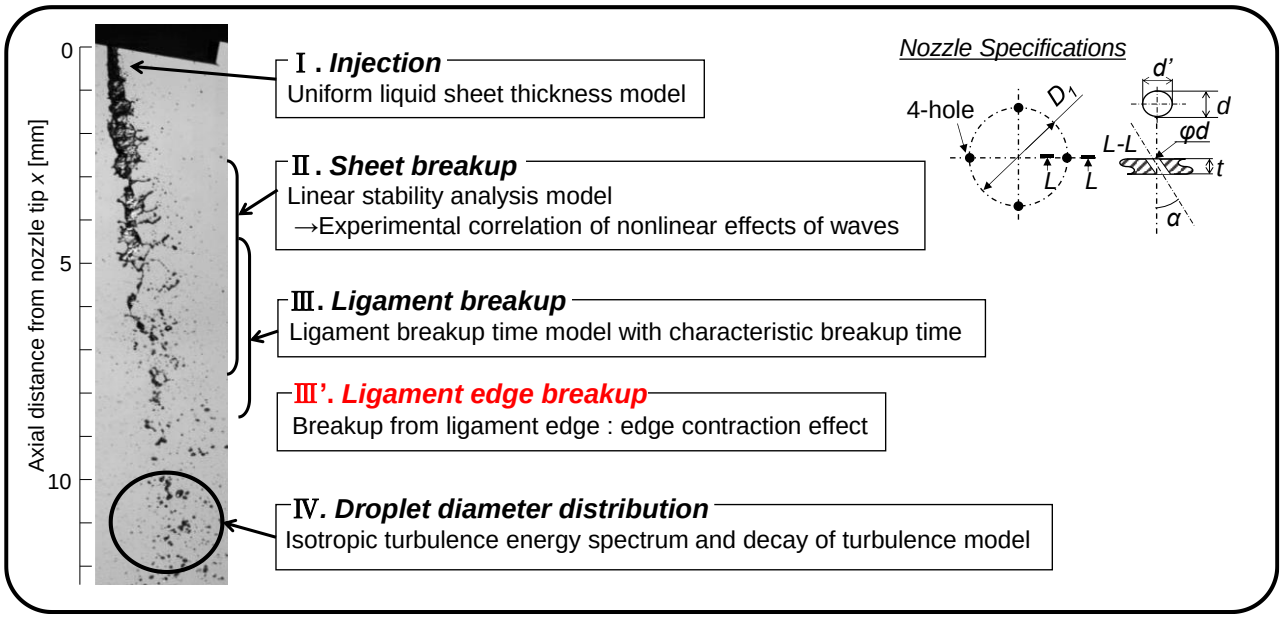

Fig. 1 Atomization model of fuel spray with multi-hole nozzle for port fuel injection.