

FLAME TRACKING – PARTICLE METHOD FOR 3D SIMULATION OF NORMAL AND ABNORMAL (KNOCKING) OPERATION OF SPARK-IGNITION AUTOMOTIVE ENGINES

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ABSTRACT

The objective of the research outlined in this article was to upgrade the Flame Tracking – Particle (FTP) combustion model developed by the authors earlier and to apply it for predicting normal and abnormal (knocking) operation of spark-ignition internal combustion (IC) engines using AVL FIRE platform. Based on 3D simulations of multiple engine test cases a new correlation for the turbulent flame velocity has been suggested which provides reasonable predictions for engine pressure curves without tuning. Application of two-stage fuel oxidation kinetics allows the intensity of preflame reactions to be continuously monitored and the conditions for knocking combustion to be identified in terms of various statistics.

KEYWORDS: Internal combustion engine, normal and knocking operation, 3D simulation, Flame Tracking – Particle method.