

Optimization of Urea Water Solution Injector for NH₃ Uniformity Improvement in Urea-SCR System

Authors : Kyoungwoo Park, Gil Dong Kim, Seong Joon Moon, Ho Kil Lee

Abstract : The Urea-SCR is one of the most efficient technologies to reduce NO_x emissions in diesel engines. In the present work, the computational prediction of internal flow and spray characteristics in the Urea-SCR system was carried out by using 3D-CFD simulation to evaluate NH₃ uniformity index (NH₃ UI) and its activation time according to the official New European Driving Cycle (NEDC). The number of nozzle and its diameter, two types of injection directions, and penetration length were chosen as the design variables. The optimal solutions were obtained by coupling the CFD analysis with Taguchi method. The L16 orthogonal array and small-the-better characteristics of the Taguchi method were used, and the optimal values were confirmed to be valid with 95% confidence and 5% significance level through analysis of variance (ANOVA). The results show that the optimal solutions for the NH₃ UI and activation time (NH₃ UI 0.22) are obtained by 0.41 and 0.125 second, respectively, and their values are improved by 85.0% and 10.7%, respectively, compared with those of the base model.

Keywords : computational fluid dynamics, NH₃ uniformity index, optimization, Taguchi method, Urea-SCR system, UWS injector

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