Numerical study of dual fuel engine using proportional natural gas split injection

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ABSTRACT
The progress of the improvement of dual-fuel diesel engines with diesel and natural gas fuel is quite significant. One of them implemented the split injection strategy or can also be referred to as multiple injections. This study analyzed the effects of natural gas split injection on the combustion and emission of modified dual-fuel diesel engines. The study was carried out numerically at 2000 rpm at low to high loads using proportional injection between the first injection (160°BTDC) and the second injection (100°BTDC). Moreover, natural gas substitution is maintained at 50% of the total fuel energy used. The simulation model is calibrated with the appropriate engine size. In addition, the model is validated with the results of experiments on engines with the same parameters. Results from natural gas split injection were compared with single-injection natural gas on different injection timings (160°BTDC and 100°BTDC). The results show that natural gas split injection has a significant effect on different loads. The split injection causes an increase in peak cylinder pressure and heat release rate thereby increasing torque at all loads compared to the single injection. Fuel consumption, CO, and HC in split injection mode are smaller compared to the single injection at 160°BTDC injection timing and greater than 100°BTDC at low loads up to 75% load. However, at high load is greater than all single injection. NOx split injection emissions at high load actually decrease compared to the single injection.

KEYWORDS
Dual-fuel diesel engines; Split injection; Proportional injection; Single injection

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