A numerical study of the influence of pilot fuel injection timing on air-fuel mixing and combustion of a dual fuel, two-stroke marine engine

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A numerical study of the influence of pilot fuel injection timing on air-fuel mixing and combustion of a dual fuel, two-stroke marine engine[1]

ARASH NEMATI, JIUN CAI ONG, Technical University of Denmark, KAR MUN PANG, JENS H. WALTHER, MAN Energy Solutions — Three-dimensional computational fluid dynamic (CFD) simulations of a dual fuel marine engine are conducted where a small amount of pilot diesel fuel is injected near top dead center, follow by a direct injection of natural gas. A skeletal chemical n-heptane mechanism (56 species) which consists of the methane oxidation reaction pathways, is utilized to simulate the oxidation of diesel and methane as well as the formation of emissions in the dual-fuel combustion. The n-heptane and methane IDT were evaluated by performing homogeneous reactor calculations. A phenomenological soot model is also considered to investigate the formation of soot. The CFD model is evaluated using the experimental pressure measurement. Effects of pilot diesel fuel injection timing is studied with an emphasis on the associated combustion and emission characteristics. It is found that by retarding the pilot fuel injection timing, a larger unburned methane cloud is formed inside the combustion chamber prior to being ignited by the pilot fuel which leads to high heat release rate. Furthermore, retarding the pilot fuel injection timing leads to a higher amount of formed soot as well as higher unburned CH_4 and CO emissions. On the other hand, advancing the diesel injection timing increases the NO emission.

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