Large eddy simulations of the influence of piston position on the swirling flow in a model two-stroke diesel engine - DTU Orbit (10/01/2019)

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Purpose – The purpose of this paper is to study the effect of piston position on the in-cylinder swirling flow in a simplified model of a large two-stroke marine diesel engine. Design/methodology/approach – Large eddy simulations with four different models for the turbulent flow are used: a one-equation model, a dynamic one-equation model, a localized dynamic one-equation model and a mixed-scale model. Simulations are carried out for two different geometries corresponding to 100 and 50 percent open scavenge ports. Findings – It is found that the mean tangential profile inside the cylinder changes qualitatively with port closure from a Lamb-Oseen vortex profile to a solid body rotation, while the axial velocity changes from a wake-like profile to a jet-like profile. The numerical results are compared with particle image velocimetry measurements, and in general, the authors find a good agreement. Research limitations/implications – Considering the complexity of the real engine, the authors designed the engine model using the simplest configuration possible. The setup contains no moving parts, the combustion is neglected and the exhaust valve is discarded. Originality/value – Studying the flow in a simplified engine model, the setup allows studies of fundamental aspects of swirling flow in a uniform scavenged engine. Comparing the four turbulence models, the local dynamic one-equation model is found to give the best agreement with the experimental results.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Thermal Energy, MAN Diesel and Turbo
Pages: 325-341
Publication date: 2014
Peer-reviewed: Yes

Publication information
Volume: 24
Issue number: 2
ISSN (Print): 0961-5539
Ratings:
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.51 SJR 0.697 SNIP 1.044
Web of Science (2017): Impact factor 2.45
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.62 SJR 0.634 SNIP 1.019
Web of Science (2016): Impact factor 1.713
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.63 SJR 0.581 SNIP 0.896
Web of Science (2015): Impact factor 1.475
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.58 SJR 0.491 SNIP 1.169
Web of Science (2014): Impact factor 1.399
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.19 SJR 0.552 SNIP 0.766
Web of Science (2013): Impact factor 0.919
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.03 SJR 0.435 SNIP 0.774
Web of Science (2012): Impact factor 1.093
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes