The XXXI-st SIAR International Congress of Automotive and Transport Engineering
"Automotive and Integrated Transport Systems" (AITS 2021),
28th-30th October 2021, Chisinau, Republic of Moldova
Conference Series: Materials Science and Engineering, 2022, Vol. 1220, Nr. 1

Investigations of pressure field along a channel of a pressure wave supercharger

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https://doi.org/10.1088/1757-899x/1220/1/012023

Abstract

The aim of the paper is a numerical investigation of the evolution of the pressure field along the wave rotor channels of a pressure wave ICE supercharger. In the present literature, most of the studies are considering the fluids as incompressible and inviscid in a 2D field. The present study is using the compressible and viscous terms in the unsteady Lattice Boltzmann method for fluid in a 3D field. The geometry was drawn in CAD software using measurements made on a real model of the CX-93 pressure wave supercharger. The simulation was conducted using a code for native unsteady LBM approach to reproduce data such as pressures, temperature and mass flows, which are usually hard to be measured in a real pressure wave supercharger. The computational domain was modelled as a moving rotational domain with adaptive refinement. Results such as velocity, pressure and temperature field in the rotor channels were obtained for exhaust gas inlet pressure of 0.292 MPa and 721 K temperature at different rotational speeds. The air inlet state considered was: 0,096 MPa and 313 K. The simulated values obtained are similar to the reported experimental results found in the literature showing a good concordance with the model.

Keywords: wave rotor channels, pressure wave superchargers, pressure fields

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