

Modelling Fluid Dynamics, Heat Transfer and Valve Dynamics in a Reciprocating Compressor

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Simulations of reciprocating compressors with present commercial CFD-programs produce very accurate and reliable results regarding valve motion, fluid dynamics and heat transfer. But, they cannot meet the demands of engineers for usability and short computation times. It turns out that a one- or two-dimensional flow model is sufficient to capture the most important physical effects during a compression cycle, namely the interaction of internal pressure waves with the valve dynamics. In order to model the heat transfer from the gas to the cylinder full three-dimensional simulations have been carried out. Inspecting the results the major physical processes have been identified and a reconstruction of the heat flux depending only on few dimensionless numbers has been proposed. The reconstructed heat fluxes have been incorporated into the simplified one dimensional compressor model allowing a heat transfer analysis of a compression cycle. In spite of simplifications and assumptions the comparisons of the simulation results to measurement data of different compressors show a very good agreement.