

ABSTRACT

Nowadays a large number of passenger cars are equipped with an a/c system. In terms of convenience as well as efficiency, the a/c system plays a significant role. The performance of the a/c system is highly dependent on the ambient conditions and is in interaction with other systems, e.g. the cooling system or the charge air cooler. This interaction may cause a non-uniform air flow distribution or an increased air temperature at the condenser inlet.

This paper discusses the influence of a non-uniform airflow at the condenser inlet on the performance of an automotive a/c system. Additionally, the influence of inserted heat from a heat exchanger which is located in front of the condenser is discussed. Therefore a refrigerant cycle with the refrigerant R134a was built up on a test stand and measurements were performed for a series of operating points.

The refrigerant cycle was modeled and simulated with Dymola / Modelica and the AirConditioning Library. The simulation model was verified with measurement data for uniform operating conditions. Afterwards the influence of a non-uniform airflow at the condenser inlet has been investigated theoretically and the obtained simulation results have been compared to measurement data. By means of further simulations key values like Coefficient of Performance (COP) and cooling capacity are discussed to evaluate the influence of non-uniform airflow on the cycle performance at different operating points.