ABSTRACT

In the last years great progresses have been achieved in the design of efficient engines for automobiles. However, the better the engines become with respect to fuel consumption, the less waste heat is available for a quick heat-up of the passenger compartment. This makes supplementary heaters necessary for a fast warm-up at low ambient temperatures. For this purpose the utilization of the R744 refrigerant cycle seems to be a promising solution. This can be realized by either reversing the refrigerant process to a heat pump cycle with the coolant or the ambient air as the heat source, or by a quite simple hot gas cycle.

The numeric simulation is an important tool for the design and optimization of the thermal management of an automobile. At low ambient temperatures the warmup behavior plays an important role. In this case the use of simulation models which consider the thermal mass of the components and thus the transient behavior is of crucial importance.

This paper describes the numerical simulation of different set-ups of a R744 cycle for supplementary heating. Experimental results built the framework for the verification of the simulation results and a comparison of an air-to-air heat pump to a hot gas cycle.

The systems have been investigated with respect to the system behavior, achievable air temperatures and capacity. Thereby special attention is drawn to the transient behavior of the system.