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Validation of STAR-CD with TCM Plug-in Tool for Thermal Comfort Simulations

Ensuring the thermal comfort of passengers is a crucial concern for passenger vehicle cabins. Passenger comfort is influenced by factors including the performance of the HVAC system, exposure to solar and thermal radiation, the thermal conductivity of the materials used in the cabin and the humidity of the surrounding air. A reliable approximation of thermal comfort parameters requires accurate numerical representation of all of these physical phenomena. This can be achieved by utilising strongly coupled solution of radiation, conduction and thermal fluid dynamics. In the present study, thermal comfort equations are implemented into STAR-CD Computational Fluid Dynamics software and compared with the results obtained by using TeKoS, which is a program package developed, validated and utilized for years at Daimler AG. The presented approach has the advantages that all physical processes are simulated in a single computer program that can be run parallel across multiple computer resources. Two test geometries under a variety of conditions are presented in this study with comparison made between wall and equivalent temperatures. The results show that STAR-CD with the TCM Plug-in is at least as accurate as the preceding TeKoS tool for thermal comfort calculations.

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