

POWERFLOW FOR DEFROST & DEMIST



3DEXPERIENCE®

Applicable industries: Automotive, Commercial Vehicles, Off-Highway Equipment & Trains

One of the most noticeable physical phenomena in a vehicle is how quickly the windshield and side windows clear on a cold morning. A mist or ice layer is an obvious safety hazard and every country has regulations specifying the maximum time allowed for defrosting/demisting. It's no wonder that defrosting and demisting are assessed by the J.D. Power and Associates' initial quality survey. The speed of the defrosting and demisting depends on many factors, including the detailed design of the HVAC ducts and registers, air temperature, velocity, and turbulence. Optimizing the design of the HVAC system can be a difficult task.

Technical Challenges

The interactions of the flow with tiny geometric details of the duct and register geometry can make a big difference in the direction, velocity, and turbulence level of the flow. This affects the spread of the flow over the windshield and side window, which in turn controls the mist film evaporation and melt rates. This complex physics behavior needs to be simulated accurately in order to correctly predict defrost and demist. Defrost and demist are by definition transient, but traditional flow simulation tools are not inherently transient and often have difficulty providing accurate results with complex geometry. The turbulent flow over the windshield and side glass is almost impossible to visualize in a physical test stand, yet these complex structures must be understood in order to optimally design the system.

SIMULIA Solution

The PowerFLOW suite is uniquely suited to address defrost and demist issues. PowerFLOW's unique, inherently transient Lattice Boltzmann-based physics allows it to perform simulations that accurately predict real-world transient conditions on the most complex geometry. PowerTHERM, coupled with PowerFLOW, provides a complete, extensively validated thermal management simulation. This enables you to identify problem areas and provide recommendations to improve the design and eliminate problems. Rapid turnaround times for model setup using PowerDELTA; simulation and visualization using PowerINSIGHT and PowerVIZ; and design modification using PowerCLAY enable you to quickly make design changes to the baseline and evaluate the improvements in defrost and demist performance.

Using the SIMULIA solution, you can:

- Evaluate the distribution of airflow and temperature on the windshield and side glass.
- Optimize the design and positioning of the ducts and registers for optimal distribution of the airflow on the windshield.
- Predict the defrost rate.
- Maximize the demist rate.

Provide confidence that regulatory tests can be passed the first time.