

PowerFLOW

PRODUCT BRIEF

ACCURATE, TRANSIENT RESULTS

Patented Lattice Boltzmann-based fluid simulation produces accurate, transient results and better functional designs.

FULLY COMPLEX GEOMETRY

Regardless of geometric complexity, PowerFLOW provides results at every time step.

IMMERSIVE GRID SETUP

Fully automatic fluid grid generation saves time and budget. Simply prepare the fully detailed model geometry, set simulation parameters and go!

TRUE ROTATING GEOMETRY

Accurate prediction of flow in and around rotating geometry enables accurate simulation for a wide range of applications.

TURBULENCE MODELS

State-of-the-art Very Large Eddy Simulation (VLES) model inherently captures the transient nature of simulations; turbulent boundary layer simulation capabilities for high Reynolds number problems.

SCALABLE PERFORMANCE

Optimized for performance and scalability, PowerFLOW scales in clustered environments up to hundreds of cores.

FLEXIBLE LICENSING

PowerFLOW is available via annual license or pay-as-you-go on-demand, with the option to run on secure, hosted, high-performance systems.

IMPROVING THE PRODUCT DESIGN & DEVELOPMENT PROCESS THROUGH SIMULATION

Unique, inherently transient Lattice Boltzmann-based physics allows Exa PowerFLOW® 4.3 to perform simulations that accurately predict real-world conditions. Using the PowerFLOW suite, engineers evaluate product performance early in the design process prior to any prototype being built—when the impact of change is most significant for design and budgets. PowerFLOW imports fully complex model geometry, and accurately and efficiently performs aerodynamic, aeroacoustic and thermal management simulations.

SOLID SOLUTIONS FOR TRANSPORTATION

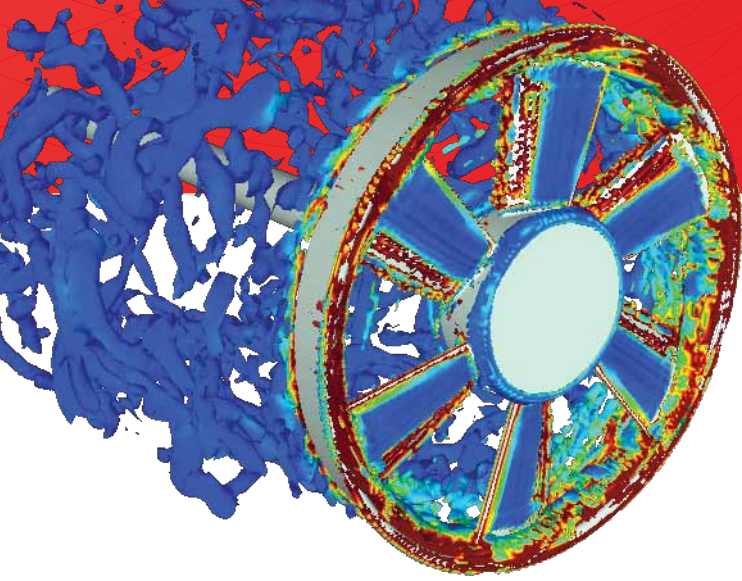
PowerFLOW accurately simulates fluid flow design problems for numerous transportation industry sectors including: Automotive, Commercial Vehicle, Off-Highway, Train, Motorsport, Motorcycle, Military Vehicle, Bus, Aerospace and others.

Exa offers validated application solutions and best practice methodology for:

- ◆ **AERODYNAMICS:** aerodynamic efficiency; vehicle handling; soiling and water management; panel deformation; driving dynamics
- ◆ **AEROACOUSTICS:** greenhouse wind noise; underbody wind noise; gap/seal noise; mirror, whistle and tonal noise; sunroof and window buffeting; pass-by/community noise; cooling fan noise
- ◆ **THERMAL MANAGEMENT:** cooling airflow; thermal protection; brake cooling; drive cycle simulation; key-off and soak; electronics and battery cooling; RoA/intake ports
- ◆ **CLIMATE CONTROL:** cabin comfort; HVAC unit & distribution system performance; HVAC system and fan noise; defrost and demist
- ◆ **POWERTRAIN:** drivetrain cooling; exhaust systems; cooling jacket; engine block

Photorealistic visualization of fully detailed Porsche Panamera using Exa PowerFLOW.





Accurate fan noise prediction
though simulation using the
PowerFLOW software suite.

TRUE ROTATING GEOMETRY

PowerFLOW's ability to simulate true rotating geometry enables practical and accurate prediction of noise and performance of HVAC and cooling fans—simply not possible using standard rotating reference frame models. It also improves accuracy for any application that has rotating components and is transient in nature. Applications include:

- ◆ Fan noise & performance: simulations for axial flow fans, centrifugal fans, mixed flow fans and cross flow fans; ability to analyze flow rates, pressure rise
- ◆ Brake cooling
- ◆ Wheel aerodynamics
- ◆ Pumps, blowers, turbines, mixers and more

COUPLED SIMULATIONS

PowerFLOW seamlessly couples with complementary Exa applications to perform expanded simulation capabilities:

- ◆ PowerTHERM®: predicts surface temperatures and heat fluxes generated with fully coupled state-of-the-art radiation and conduction solver
- ◆ PowerCOOL®: predicts heat exchanger performance and top tank temperatures with fully coupled cooling system simulation model
- ◆ PowerACOUSTICS™: aeroacoustic noise prediction and analysis
- ◆ Easily export to other solvers for fluid structure interaction simulation

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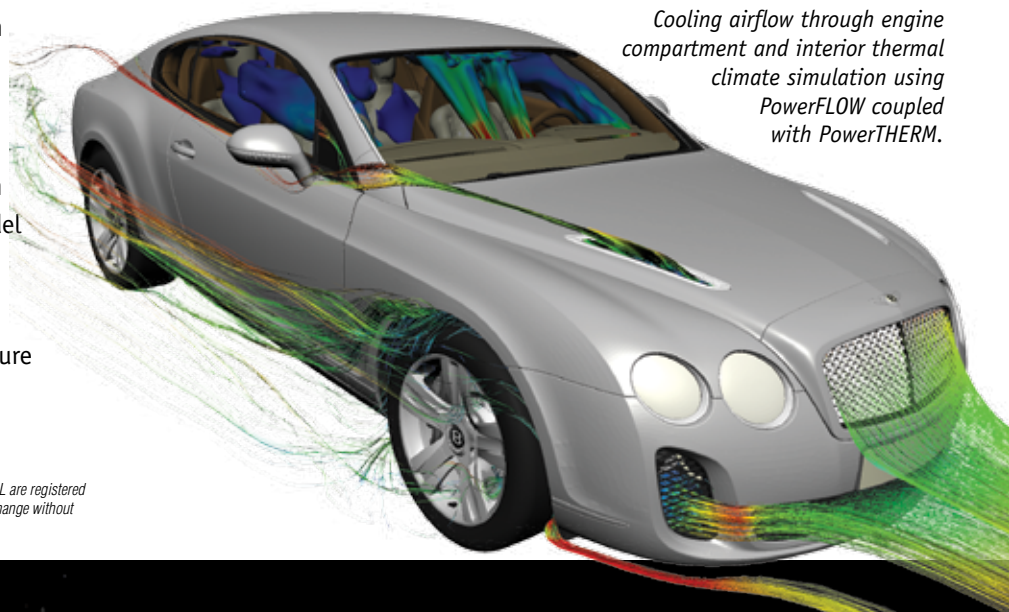
DIGITAL WIND TUNNEL™

For validation with experimental data it's important to simulate the physical wind tunnel setup along with the model.

- ◆ For external flow studies, PowerFLOW comes with ready-to-use parametric digital wind tunnel templates for aerodynamic and aeroacoustic simulations
- ◆ Standard digital wind tunnel templates may be customized to conform to your wind tunnel
- ◆ The Digital Wind Tunnel model includes:
 - Static and moving ground plane modeling to more accurately reflect real world conditions
 - Boundary layer suction point to match experimental wind tunnels
 - Specification of a known experimental boundary layer inlet profile

RAPID SIMULATION TURN-AROUND TIME

- ◆ PowerFLOW is architected from the ground up for operation in high performance computing environments in order to achieve the fastest possible simulation times—providing near linear scalability up to hundreds of processor cores
- ◆ Fast time to solution: setup, grid generation, simulation and results analysis in less than a day
- ◆ One model, many simulations: once a surface mesh model is prepared, the same model may be used to perform additional simulations (such as thermal or aeroacoustic) using Exa's integrated suite of products.



Cooling airflow through engine
compartment and interior thermal
climate simulation using
PowerFLOW coupled
with PowerTHERM.

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