

POWERFLOW FOR LOAD SIMULATION

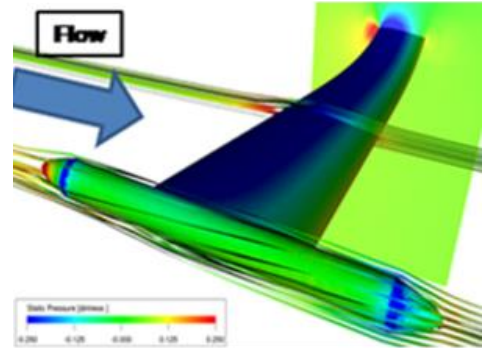


3DEXPERIENCE®

Aerodynamic Load Simulation for Aircraft

Finding the right trade-off between drag and weight is a key challenge in wing design. A thinner transonic wing has lower drag but will also be much heavier, which adversely affects the airplane performance. And as any passenger can see through an airplane window, the wing will deform under aerodynamic loads.

Finding the right answers to these challenges early in the design process through simulation can dramatically reduce development costs by eliminating expensive model builds and wind tunnel tests later in the process. In addition, the ability to predict loads on small components (such as slats and flaps of a high-lift wing) enables you to design the support structures required for these components with the correct dimensions in the design phase, thus reducing weight significantly and avoiding overdesign.



Technical Challenges

To understand the trade-off between a wing's performance and its weight, you must be able to predict the aerodynamic loads and how the structure will react to these loads. This requires both an accurate flow solver and a structural solver, and automatic coupling between the two. The flow solver predicts the distributed aerodynamic loads (static or dynamic) and transfers these loads to the structural solver in the appropriate format to predict the wing deflections.

Most CFD tools used today do not provide an automatic coupling between the flow and structural solvers required for productive use. Therefore, most aerodynamic predictions assume a rigid wing — a significant potential source of error leading to overdesign and expensive fixes later in the process.

SIMULIA Solution

The PowerFLOW suite provides all the components needed for accurate load prediction, PowerFLOW is inherently transient, and can easily and accurately predict surface pressure fluctuations that cause static loads and vibrations. This enables you to predict deformation problems — either for entire wings or individual components. Static and transient loads can be coupled with structural solvers to compute static deformation and vibrations.

PowerFLOW's ability to take into account even the most detailed geometric structures enables you to predict static loads on small components such as flaps and slats. In addition, support structures such as brackets and fairings can be optimized using PowerFLOW, providing significant weight reductions.