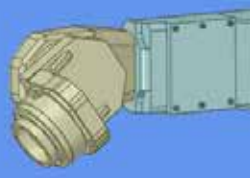
ANSYS DISCOVERY LIVE: *Real-Time Simulation Revolution*



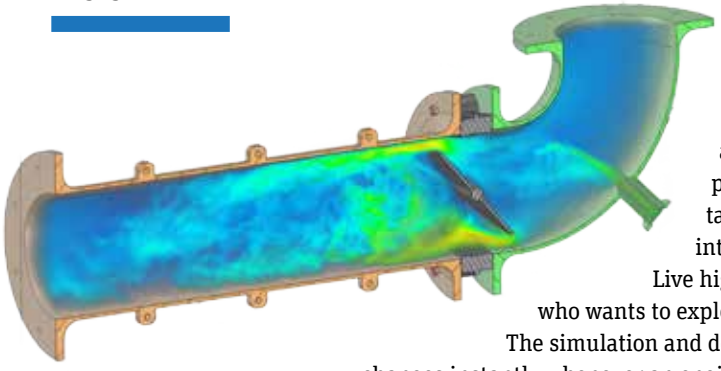
With the revolutionary new ANSYS Discovery Live solution, simulation is no longer a matter of hours or days — it is instantaneous. Engineers can start seeing simulation results in seconds after importing a geometry, with no need for a high-performance computing system. That is because all the computing is handled by the graphics card (GPU), which has thousands of processors running in parallel. Without pausing the simulation, they can change the design and physics and immediately view the results. This interactivity and instant feedback lets engineers experiment with more variables early in the digital exploration stage of the design process, which is vital to developing successful products in a highly competitive market.

By **Justin Hendrickson**, Director, Product Management, ANSYS

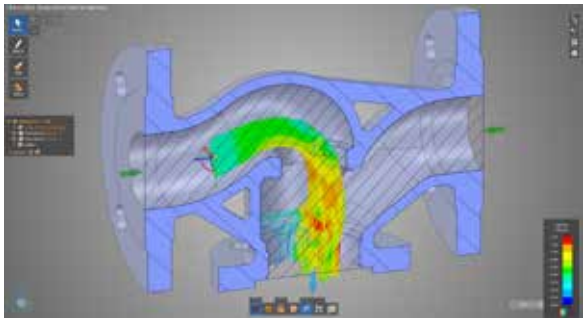
For the first time, engineers can explore design options using interactive physics in real time. A revolutionary simulation solution called ANSYS Discovery Live enables early design exploration and virtual experimentation in fluid, thermal, structural and modal applications. It makes simulation faster and easier than ever by reducing setup, solving and post-processing time to near zero.

ANSYS Discovery Live is intended for engineers who are not full-time simulation analysts. It enables them to concentrate on product design and physics while the simulation takes care of itself. Ease of use, speed and interactivity are key features that make Discovery Live highly valuable to the non-expert simulation user who wants to explore the possibilities of many design options.

The simulation and design exploration is truly "live": The simulation changes instantly whenever an engineer alters the conditions, without pausing or restarting the process. The effect is the same as experimenting with the design in real time. Engineers can make decisions to switch between physics, modify geometry on the fly and change the way results are displayed, all live.



Engineering insights and trends are instantaneous, regardless of changes to boundary conditions such as flow rates, material types and inlet pressure.



The user can choose the way results are displayed, such as this streamline representation of gas flow through a pipe.

GPUs Make Real-Time Simulation Possible

Discovery Live is possible due in part to the dramatic increase in computational power provided by graphical processing units (GPUs), which now exceed the power of central processing units (CPUs). The newest GPUs can approach supercomputing capacities and speeds, so simulations can be completed in seconds instead of hours. GPUs have an order of magnitude more compute power than CPUs. A $500 GPU card today has thousands of processors running in parallel; a similar CPU card has eight. While individual CPU cores are somewhat faster than GPUs, ANSYS decided to take advantage of the overwhelming improvement in compute power — resulting in a thousand-fold speedup in time — to obtain simulation results in seconds instead of minutes, hours or days.

"I was blown away by the speed and ease of use of Discovery. The time to complete an analysis is on the order of minutes as opposed to hours. You will be able to perform your first analysis in less than 15 minutes."

— **Travis Jacobs,** Founder & Principal, Jacobs Analytics

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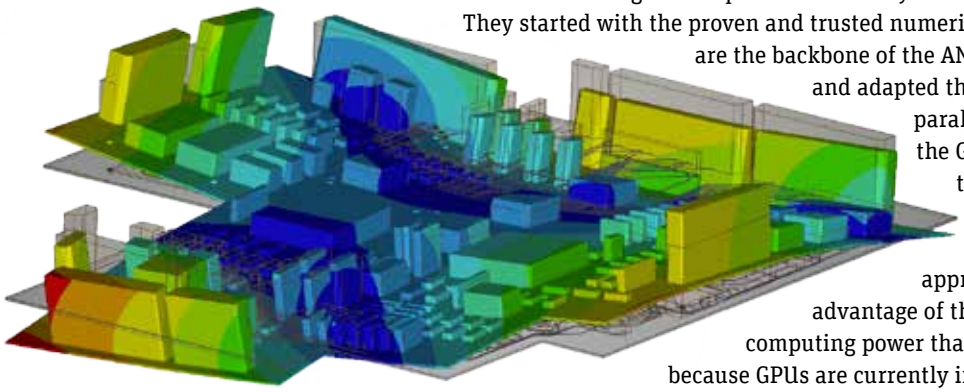


A 1,300-part modal simulation is solved in 30 seconds.

Writing Software for Massively Parallel Solvers

Software written for CPUs will not run on GPUs automatically. ANSYS engineers built a new solver from the ground-up to work natively on the GPU architecture. They started with the proven and trusted numerical methods that are the backbone of the ANSYS product line and adapted them to the massively parallel architecture of the GPU. This involved the invention of new, proprietary algorithms and approaches that take advantage of the tremendous computing power that GPUs provide. And, because GPUs are currently improving faster than Moore's law predicts (while CPUs are evolving more slowly), basing Discovery Live on GPUs ensures speed and computation improvements for many years to come. Another key was adapting ANSYS SpaceClaim as the platform for Discovery Live. Because Discovery Live includes all of SpaceClaim's tools for creating and modifying geometry, engineers can take any 3-D model and not only simulate it, but also change it, all while the simulation is running. As soon as a modification is made, the result instantly updates, with no re-meshing involved. For simulation to be a driving force in 3-D design, it is critical that a designer be able to make edits to improve a design within the simulation itself.

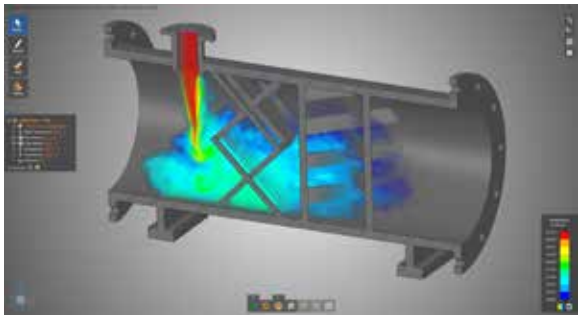
"This is by far the fastest, easiest and most intuitive tool I've seen for CFD. Starting with a parametric model, skipping the mesh and watching it steady up in real time is really something special. Being able to modify the components in real time speeds up iteration intervals in a way I haven't been able to calculate."

— **Waylan Elmenhurst**, Founder and Principal, 4D RD&D

Model Complexity is No Longer a Factor

With Discovery Live, running quick structural simulations of an entire engine block, complete with cooling channels and tens of thousands of faces can be done in a matter of seconds. The user simply has to choose a material; apply a load to, for example, the piston cylinder faces where combustion will take place and generate a lot of force; and see the stresses throughout the entire 3-D volume of the engine in seconds. They can even animate the simulation deformation results with a simple click.

How can a complex engine block with tens of thousands of faces be solved so quickly? The answer is that the complexity of the shape is not a significant factor in solve time. Simulation in Discovery Live depends primarily on the volume of the geometry being solved, not its complexity.



Instant volumetric thermal simulation shows mixing of fluids.

Gaining Flexibility with Little Loss of Accuracy

Discovery Live enables the user to choose higher speed or higher fidelity for a given simulation. In effect, this

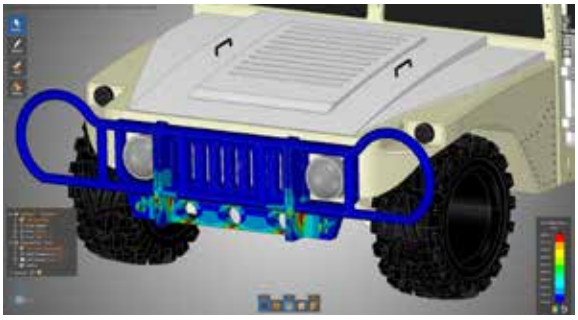
Speed of Discovery Live
ansys.com/speed

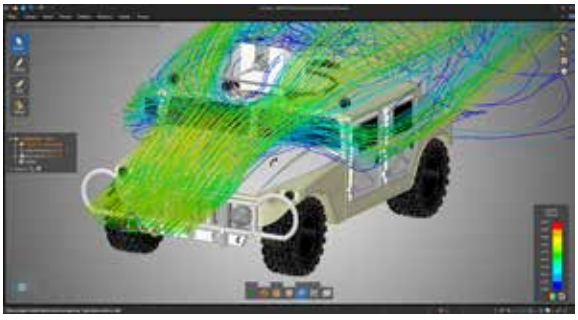
"I never thought I'd be able to do CFD modeling unless I pursued a higher level engineering degree. I was able to complete structural simulations in Discovery Live after tinkering with it for just a few hours. The intuitive UI made it easy for me to utilize which streamlined my solution process."

— **Olivia Lim**, Materials/Structures Engineer, Airloom Energy

sets the size of the smallest feature that will be resolved and allows the user to make the trade-off between simulation speed and fidelity.

The interactivity and speed of Discovery Live provides engineers with unprecedented flexibility to explore design options very early in the development process. This flexibility encourages investigation of many more possibilities in a short time, potentially uncovering new or breakthrough ideas that can then be refined and further developed. Discovery Live provides directional solutions — indications that changing a certain parameter or geometric feature moves the design in the desired direction. Once a promising design is identified in Discovery Live, engineers can seamlessly export it to ANSYS Mechanical, ANSYS CFD or ANSYS AIM software to run simulations for high accuracy and higher-fidelity results.





Discovery Live can easily switch between physics — from the external airflow around a vehicle to the mechanical stresses on the same vehicle — in seconds.

Seeing is Believing

With Discovery Live, ANSYS takes simulation in a whole new direction that will enable all engineers to benefit, no matter their level of expertise. The ability to see simulation results almost instantly is a quantum leap in how engineering simulation will be employed in the future. Real-time results that were never before possible, when utilized early in product development, save costs later, when design changes become exceedingly expensive. Better still, leveraging the tool's interactivity, users can experiment with more design options. Extensive early experimentation can uncover novel designs that may have been missed using traditional processes, resulting in breakthrough products. That is why it's called ANSYS Discovery Live: For the first time, every engineer will have the power of live experimentation to help them discover and unlock the next big idea.

THE FOUR KEY STRENGTHS OF DISCOVERY LIVE

1) **SPEED.** Simulation is so fast it seems "live." The computational power of GPUs coupled with an efficient architecture from ANSYS makes this speed possible.

2) **EASE OF USE.** Meshing is eliminated and the software makes all simulation setup decisions so the user can concentrate on the physics and not on the solver.

3) **NEW METHODS.** New simulation methods allow for simulation of dirty CAD geometry or faceted data such as an STL file. These approaches mean that model complexity will not slow down the solve time.

4) **INTERACTIVITY.** Interactive functionality enables engineers to change physics, geometry and result displays on the fly, allowing for exploration of ideas as fast as they occur.

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