FUJITSU

TECH INSIGHT

PRODUCT DEVELOPMENT

Powerful new technologies, including real-time visualisation, simulation and VR, are transforming CAD-centric workflows for product development and manufacturing firms

Technology used in product development is evolving at a very fast pace. 3D design and engineering software continues to be at the heart of the process, but the three dimensional product models generated are now driving many more downstream and complementary workflows and tasks.

With easy access to a much wider variety of tools, product designers and engineers can gain a much deeper understanding of how a product looks, feels and performs. Technologies including design visualisation, virtual reality (VR), and simulation can all help support more robust decisions about aesthetics, functionality and performance.

UP FRONT INFLUENCE

Importantly, many of these supporting technologies can now be used much earlier on in the development process, long before designs have fully evolved. Getting greater insight at the exploratory phase encourages experimentation and gives designers the confidence to explore bold new ideas. In contrast, when this feedback is received much later on, any significant change in development vector may prove very costly, both in terms of time and money.

In order for designers and engineers to fully embrace these new technologies, they not only need to be tightly integrated with CAD, and easy to use, but have to deliver results quickly. And with new generation software that is accelerated by GPUs, this can take a matter of seconds.

In simulation, for example, with an optimised design, test, iterate workflow, designers can quickly realise that a design concept might have big structural challenges later on. With physically-based rendering, designers can make decisions on colour, materials, and finish (CMF) long before a physical prototype is made.

OPPORTUNITIES AND CHALLENGES

These exciting developments in technology present a huge opportunity for design and manufacturing firms, but they're not without challenges. In addition to workflow optimisation and training, the workstation requirements for design visualisation, VR and simulation are very different to those for 3D CAD.

And in order for firms to get the most out of these transformative new technologies, they will need to ensure that product designers, engineers and manufacturing professionals have access to the right workstation hardware.

▶ Over the page: spotlight on five key workflows
CAD, VR, visualisation, simulation, manufacturing prep

KEYSHOT IMAGE COURTESY OF LUXION

Produced by DEVELOP3D

Sponsored by FUJITSU NVIDIA

3D DESIGN & ENGINEERING (3D CAD)

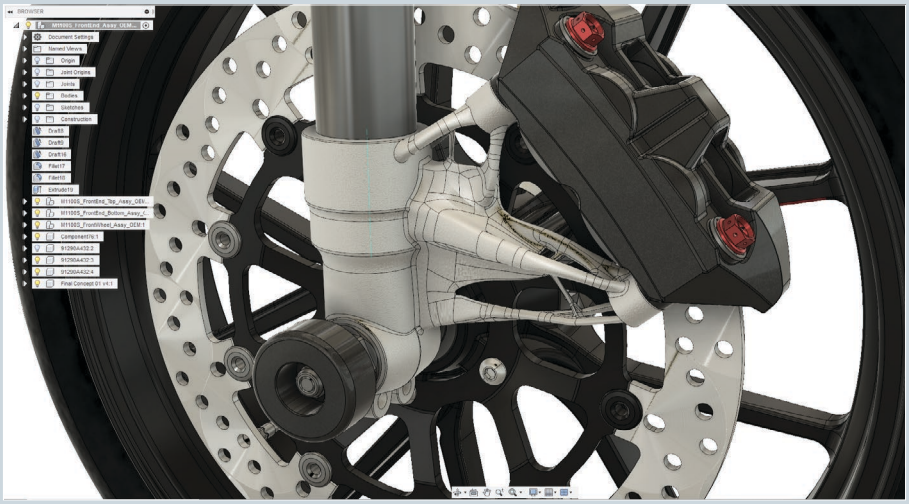
Computer Aided Design (CAD) software plays a central role in product development, featuring a range of modelling tools including parametric or direct modelling for mechanical design, and surface or sub division modelling for more organic forms.

Models can be used to generate assets including 2D drawings and Bills of Materials (BOMs), as well as drive downstream workflows including design visualisation, simulation and CAM programming for CNC machining.

Leading CAD tools including Autodesk Inventor, Autodesk Fusion 360, DS SOLIDWORKS, PTC Creo and Siemens NX are all tested and certified to run on FUJITSU CELSIUS workstations.

In terms of workstation specifications, CAD tools will generally benefit from a high frequency CPU, and GHz should be prioritised over the number of cores.

The GPU requirements of CAD software are relatively low so an NVIDIA® Quadro® GPU with up to 5GB of memory should deliver good 3D performance in most CAD software. Quadro® is designed specifically for professional applications.



AUTODESK FUSION 360 IMAGE COURTESY OF AUTODESK

We are now starting to see a new wave of software designed to truly support the 'A' in Computer Aided Design. This includes generative design, which can generate multiple options for early stage design exploration, or topology optimisation which is used to deliver a single optimum design.

Both technologies can harness the computational power of a FUJITSU CELSIUS workstation to generate results from a set of design and performance requirements. PTC Generative Topology Optimisation Extension, for example, can harness the power of NVIDIA® Quadro® GPUs. nTopology's nTop Platform can take advantage of multiple CPU cores.

VIRTUAL REALITY (VR)

Virtual Reality is being used throughout product development, with its biggest impact being felt in the automotive, aerospace, heavy machinery and manufacturing sectors. It can be used for design exploration, virtual prototyping, design/review, as well as production, assembly and maintenance.

VR can be experienced through a cave or powerwall environment, or by using head-mounted displays (HMDs).

With a focus on visual quality, VR can aid aesthetic decision making. Here, the use of physically-based materials and dynamic lighting in applications like Unreal Engine, KeyVR, Autodesk VRED and Unity can help make products look incredibly real. High resolution HMDs like the Varjo VR-2 Pro are ideally suited to these workflows.

Functional and ergonomic performance can also be validated in applications including ESI Group IC.IDO and SkyReal. Realistic mock-ups can include motion simulation, so users get a physical behavioural experience as well as a fully immersive and realistic visual experience. Parts can be 'virtually' assembled and disassembled for serviceability checks or training. Manufacturing processes can be simulated to make the production line safer and more efficient.

IMAGE COURTESY OF SKYREAL

VR has quite substantial hardware requirements, especially when it comes to graphics. A FUJITSU CELSIUS workstation with one or more NVIDIA® Quadro® RTX GPU is recommended to deliver a smooth VR experience.

CAD models need to be optimised so they can run efficiently in VR and a balance needs be struck between maintaining engineering accuracy and 'lightweighting' the model so users get a good experience. This process of tessellation is often multi-threaded so will benefit from a CPU with multiple cores.

DESIGN VISUALISATION

Physically-Based Rendering (PBR) is used to generate photorealistic stills and animations. Designers and engineers can see precisely how a product will look once manufactured, significantly improving decision making and communication, as well as reducing product development cycles and the need for physical prototypes.

PBR achieves realism through the use of physically accurate materials and by simulating the way light behaves in the real world, as it reflects off and refracts through objects, or is absorbed by others.

In recent years there has been a huge rise in the use of Graphics Processing Units (GPUs) for PBR. This has been fuelled in part by NVIDIA® RTX technology which can deliver rendering output very quickly. With one or more of the most powerful NVIDIA® Quadro® RTX GPUs inside a FUJITSU CELSIUS workstation, results can even be near instant.

NVIDIA RTX takes a more intelligent approach to rendering. RTX GPUs feature CUDA cores for graphics computation, RT cores for ray tracing and Tensor cores for AI denoising, all of which combine to rapidly accelerate render times.

LUXION KEYSHOT RENDER COURTESY OF DEVELOP3D

There are several RTX-enabled applications including SOLIDWORKS Visualize, Luxion KeyShot, Autodesk VRED, Unreal Engine and Chaos Group V-Ray. RTX is also at the heart of NVIDIA Omniverse, a new platform technology which brings together designers and other stakeholders in a visually rich environment.

CPU rendering is still important, particularly when working with huge datasets, very high-res measured materials and exceedingly complex HDRi environments, when large amounts of system memory become very important. CPU ray tracing is highly multi-threaded so will benefit from a CPU with lots of cores.

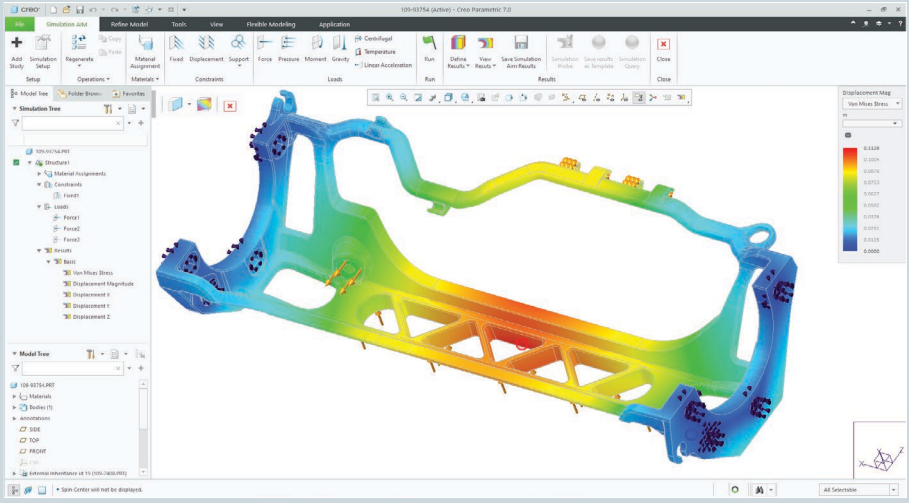
SIMULATION & ANALYSIS

Simulation has traditionally been used at the latter stages of the development process, to verify that a product performs as required or to help investigate failures in service. This could be in terms of its structural strength, aerodynamics, fluid flow efficiency, or heat transfer properties.

More recently, simulation has been brought up front in the design process, where it can have a much bigger impact. It can be used to explore new ideas, even generate them from scratch, and give designers confidence to take products on bold new development vectors.

In order for simulation to truly influence design, it needs to be easy to use and robust results need to be delivered very quickly. Ansys Discovery is a new GPU-accelerated simulation-driven design tool that does exactly that.

With a FUJITSU CELSIUS workstation powered by an NVIDIA® Quadro® GPU designers and engineers can get results in seconds. It means many different design concepts can be explored before moving into the detailed design phase. Decisions can be based on performance data from static structural, static and transient thermal and fluid flow analyses.



PTC CREO DISCOVERY LIVE IMAGE COURTESY OF PTC

There are also many heavyweight computer-aided engineering (CAE) software tools that can take advantage of the enormous computational power of one or more high-end NVIDIA® Quadro® GPUs. These include SIMULIA Abaqus, Ansys Mechanical, Autodesk Nastran, Altair AcuSolve, Ansys Fluent and others.

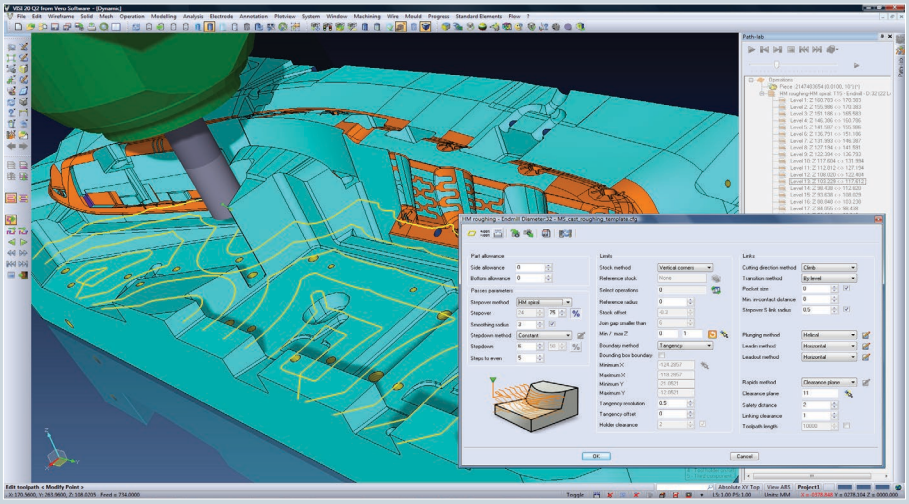
CPUs still have an important role to play in many other CAE software tools. Datasets can be huge and there are performance benefits to holding them entirely in memory. If that is not possible, fast storage becomes even more critical as applications continually need to move data between drive and memory.

MANUFACTURING PREPARATION

Once a product has been designed and optimised it needs to be manufactured. There are many different production methods and preparation technologies, from the development of efficient sheet metal forms to the design and simulation of moulds; from Computer Aided Manufacturing (CAM) programming of numerically controlled milling and turning, to additive manufacturing; from robot programming to full digital factory simulation.

CAM is one of the most prevalent technologies. It is used to generate and optimise machining toolpaths which drive CNC machines for the precision manufacturing of components in metal and many other materials.

Toolpath generation is a very compute intensive process, and one that can be accelerated by a FUJITSU CELSIUS workstation with a multicore CPU. Most CAM software has limits to how many CPU cores can be used for any single toolpath calculation, although multiple toolpaths can be calculated in parallel.



VERO IMAGE COURTESY OF HEXAGON AB

Additive manufacturing (AM), or 3D printing for industrial applications, is used to manufacture parts by depositing materials in layers.

AM still makes up a relatively small part of the overall manufacturing landscape, but there is a huge amount of development work in progress, in terms of machines, materials and software.

Dyndrite, for example, has developed a geometry engine that can be used as the foundation for additive manufacturing software. It requires an NVIDIA® GPU to accelerate additive specific computations and benefits from a compute focused GPU like the NVIDIA® Quadro® GV100.

FUJITSU CELSIUS - ADVANCED WORKSTATIONS FOR ALL WORKFLOWS

With professional grade NVIDIA® Quadro® GPUs and Intel® Xeon® CPUs, FUJITSU CELSIUS workstations are designed and engineered in Europe, and have gained a reputation for being reliable and whisper quiet, thanks to advanced thermal management

FUJITSU CELSIUS J SERIES

No need to choose between performance and size in a Small Form Factor (SFF). CELSIUS J series workstations offer high-end performance in a compact design and are ideally suited to CAD and entry-level simulation and CAM workflows.

FUJITSU CELSIUS W SERIES

A great combination of performance, price, expandability and energy efficiency in a microtower design. The CELSIUS W series is a good all-rounder, well suited to CAD, design visualisation, VR, simulation and CAM.

FUJITSU CELSIUS M SERIES

Optimised for the most demanding workflows including high-end real-time viz, VR, rendering, and simulation and CAM, the CELSIUS M series combines high-spec CPUs, GPUs and memory with near silent noise emissions.

FUJITSU CELSIUS R SERIES

This reliable, high-end dual processor desktop workstation is optimised for extremely demanding and memory intensive multi-threaded workflows, including design visualisation, ray trace rendering, and advanced engineering simulation.

FUJITSU CELSIUS H SERIES

For work at the office, at home or on the shop floor, CELSIUS H series mobile workstations combine stylish design with maximum security thanks to optional palm vein technology. Available in a 15.6-inch form factor, models can be configured for a variety of workflows including CAD, visualisation, VR, simulation and CAM.

FUJITSU CELSIUS C SERIES

The CELSIUS C series of rack workstations offers full workstation performance in a 1U chassis designed for the datacentre. The machine can be configured for Remote Access (1:1), GPU pass-through or graphics virtualisation (1:n), to support a variety of workflows from CAD to design viz.