AN ENGINEER'S GUIDE

TO CAD AND THE RENAISSANCE
OF PRODUCT DESIGN

ptc

creo®

WHAT'S POWERING ALL THIS NEW ACTIVITY?

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A renaissance of design is underway and CAD systems need to keep up. New technologies are reinvigorating every step of product development, from how engineers create designs, to the review process, and even model validation.

TECHNOLOGIES SUCH AS:

> Generative Design
> Simulation
> Additive Manufacturing
> Augmented Reality
> Model-Based Definition

There's never been a more exciting time to be a product developer - or a greater risk of falling behind.

Read on to learn more about how breakthrough technologies are spurring the renaissance and how you can incorporate one or more of these exciting capabilities into your own product development process.
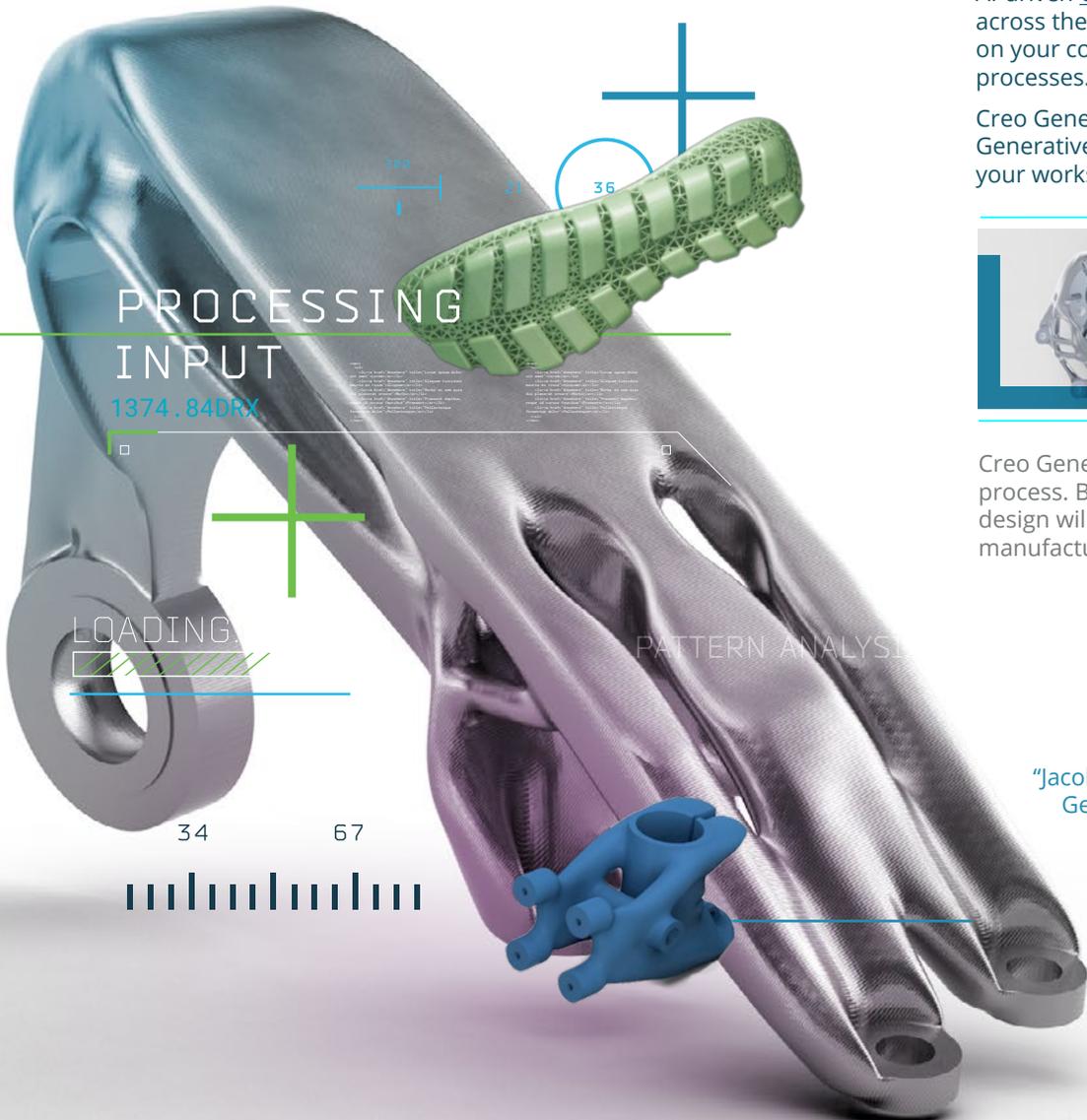
ptc

"As companies work to bring their products to life digitally, they're turning to generative design, simulation, design for additive manufacturing, augmented reality and model-based definition.

Brian Thompson,
DVP and General Manager, CAD, PTC.

GENERATIVE DESIGN

AI-driven Creo Generative Design can help you unleash digital transformation across the enterprise. Generative Design automatically delivers solutions based on your constraints and requirements – including materials and manufacturing processes.

Creo Generative Topology Optimization (GTO) extension and cloud-based Generative Design extension (GDX) bring the power of generative design right to your workstation.

Realize benefits from sales through engineering into manufacturing and service. Improve engineering productivity and time-to-market with rapid exploration of innovative CAD models, all within the Creo environment.

Creo Generative Design supports parametric changes, allowing for an interactive process. Both experienced and junior engineers will benefit, as generative design will help challenge assumptions and deliver high-quality, lower-cost, manufacturable solutions.

PROCESSING INPUT

1374.84DRX

LOADING

PATTERN ANALYSIS

"Jacobs expects that using Generative Design will shorten design time by 20% and produce parts which are incredibly lightweight, resulting in significant fuel savings."
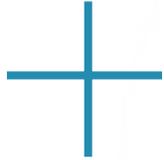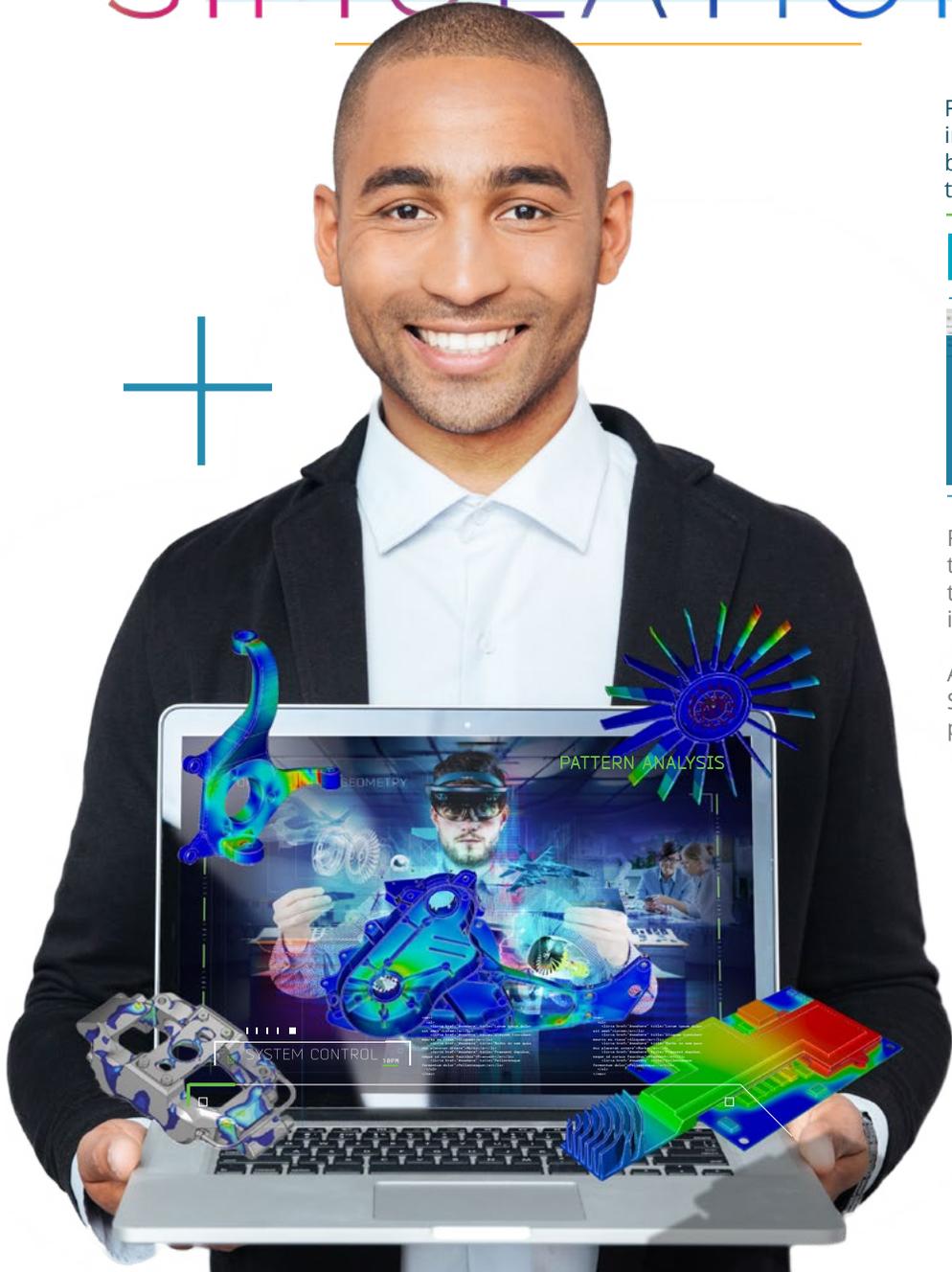
Jacobs
American NASA Contractor

Jacobs

SIMULATION

For decades, engineers sent their work to analysts after making all the important design decisions. It might take a day or two, sometimes a week, but eventually, the experts returned simulation results to the engineer—who then made changes to the model and sent it back to the analyst. And so on.

›› REAL-TIME SIMULATION COMPLETELY CHANGES THAT PARADIGM.
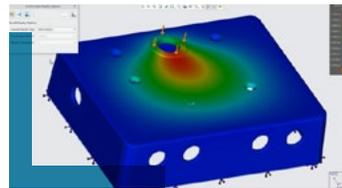
Creo Simulation Live puts Ansys' real-time simulation technology inside a parametric modeler that design engineers can use to guide their design decisions.

Real-time simulation puts fast thermal, structural, and modal analysis tools directly in the CAD environment. It is easy-to-use and built specifically for design engineers, so they can use simulation to drive their design. That means design engineers can try out innovative ideas—and see the results in seconds, not days.

And if you need a high-fidelity, high-accuracy simulation tool, the Creo Ansys Simulation solution includes embedded Ansys solvers to analyze and validate design performance before committing to production.

"Real-time simulation is the perfect solution to help me design new products that work the first time. It is so easy to set up, runs fast, and automatically stays synchronized with my design changes."
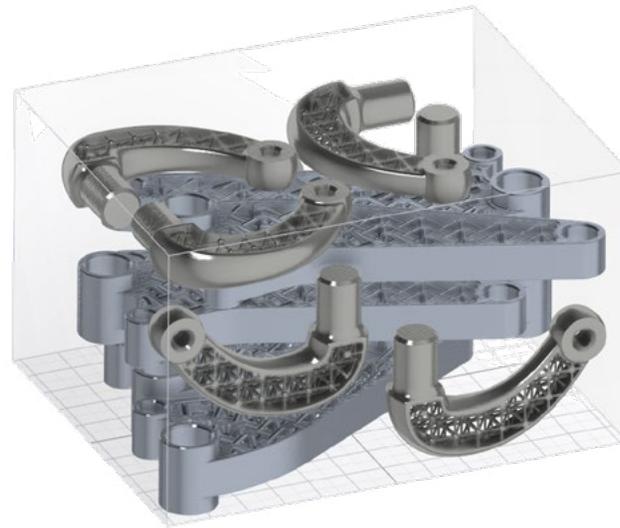
SQlab,
German Cycling Ergonomics Company

ADDITIVE MANUFACTURING

With all the recent attention on additive manufacturing, it's easy to forget the role CAD plays. To ensure a successful physical product, CAD vendors collaborate with popular platforms (think EOS, 3D Systems, Materialise). You can go directly from design to print, without intermediate steps.


Advances in CAD further help with the task of [designing for additive manufacturing](). It can help with optimizing layout of assemblies in the print tray—even specifying build direction (especially helpful for anyone concerned with reducing support structures, material used, and printing time). The latest CAD systems further help optimize, validate, and print check models—for polymers and metal.

BUT THAT'S NOT THE MIND-BLOWING PART.

Since additive manufacturing isn't constrained by traditional fabrication methods, it can print parts from designs you might never have imagined. For example, instead of a solid, why not save weight and material costs by using lattices? You can even adjust the lattice structure based on simulation results.
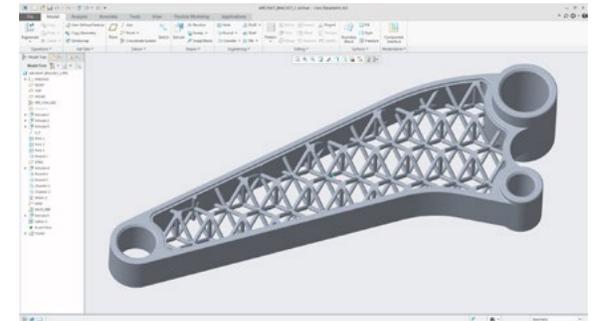
With Creo, you can easily connect to numerous printers and online service bureaus. Creo Additive Manufacturing extension (AMX) enables lattice creation and optimization. And Additive Manufacturing Advanced extension for Materialise (AMX Advanced) allows you to direct connect to metal printers in the Materialise library and automatically generate metal support structures using Materialise Magics.

AUGMENTED REALITY

The problem with designing products on a (relatively) tiny screen, is that you can't always anticipate how they'll work in real life. And sharing them safely can be problematic. But augmented reality (AR) changes everything. With this technology, 3D models become experiences that can be placed in real-world scenes at scale. Best of all, it offers an efficient way for engineers to share design information and collaborate securely with colleagues, suppliers, customers, and manufacturing partners.

Creo AR Design Share is used to show a large mechanism inside a jet as an engineer walks around an airplane. Note that even information picked up by sensors, such as temperature, is projected onto the digital AR image.

Remarkably, CAD Software today can create AR experiences from your 3D models in seconds, saving you hours of work. Secured in the cloud, AR can demonstrate your work at-scale for 360° design reviews without exposing your IP. Since recipients can launch your AR models easily with a click of a button, you can use them to collaborate with team members and stakeholders anywhere. Some CAD systems even generate models viewable in mixed reality (think HoloLens goggles), as well as on mobile devices.

"By seeing the products to scale against a real-world backdrop, you can **prevent iterating costly and time-consuming physical prototypes,** and identify potential manufacturing issues early."

Dave Martin,
MCAE Consulting

MODEL-BASED DEFINITION

PATTERN ANALYSIS

LINK.01

ACTIVE.02

ENGINE STATUS 67.242
MEDIAN RANGE 48.021

HEAT STATUS 39.871
LOAD STATUS 57.20

1374.84DRX

LOADING...

Including vital information in 2D drawings can prove troublesome. As the 3D model changes, old drawings become outdated. Complicating matters, engineers may communicate tolerances, materials, and other key data differently.

That's where model-based definition (MBD) comes in. It allows designers to add detailed annotations to 3D models that would have previously been expressed in 2D drawings. Anyone with access to the digital file can reach the most current revision, too. This "single source of truth" forms the basis for digital transformation across the enterprise.
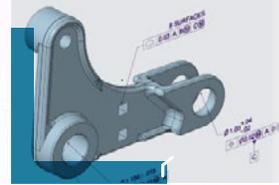
In this model, created in Creo, annotations stay with the 3D model.

As part of the CAD system, MBD helps designers add product manufacturing information (PMI) and geometric dimensions and tolerancing (GD&T). Most importantly, newer MBD technologies make sure this data meets the latest ASME and ISO technical standards.

"Product MBD/Quality lives and dies by the PMI (Product Manufacturing Information) embedded in the 3D MBD model."

Curtis Brown,
Principal Mechanical Engineer,
Honeywell FM&T

PRODUCT DATA MANAGEMENT

Before data management systems were widespread, engineers could lose 25% of their time looking for or recreating parts. Product data management (PDM) and product lifecycle management (PLM) solutions like Windchill help companies manage, share, and review multi-CAD and product data.

Windchill can even manage data on the cloud, or on-premise. Collaborate within your company or with suppliers and external partners with dedicated collaboration spaces. Easily reuse your parts across designs to save time.

Windchill enables the digital transformation of the BOM into a universal, consolidated view of all product data. This creates a continuous digital thread – a seamless flow of data extending upstream and downstream from engineering.

"Initially we implemented [Windchill] on some projects and gradually we have integrated it to the rest of the areas within the company. The capability whereby the whole world can consult on **information which we know has been updated in real time, is essential.**"

Forma 5
Spanish Office Furniture Manufacturer

LARGE ASSEMBLIES AND CONCURRENT ENGINEERING

Design engineers handle everything from the most basic designs up to hundreds of thousands of parts in the most complicated products imaginable. That's why CAD systems now offer enveloping and shrinkwrap methods that simplify sub-assemblies and parts that don't concern the work at hand. By "lightweighting" the parts, designers reduce load and response times. In short, they spend less time waiting and more time focused on their work.

For an assembly such as this large train engine design with Creo, a skeleton model can define design intent and product structure. Master definitions of geometry in the skeleton allow multiple designers to work on the details concurrently.

Creo can also include advanced assembly capabilities to support top-down design and concurrent engineering, such as skeleton models and data-sharing. When the primary design intent changes, the individual sub-assemblies adapt. Teams with these CAD capabilities can design in parallel on an assembly, increasing productivity and greatly reducing time to market.

> "Many of our customers are reshoring so we need to stay nimble. We upgraded our system because we needed **a solution that would support large assemblies that routinely contained more than 5,000 unique parts.**"

JR Automation, American Provider of Automated Manufacturing Solutions
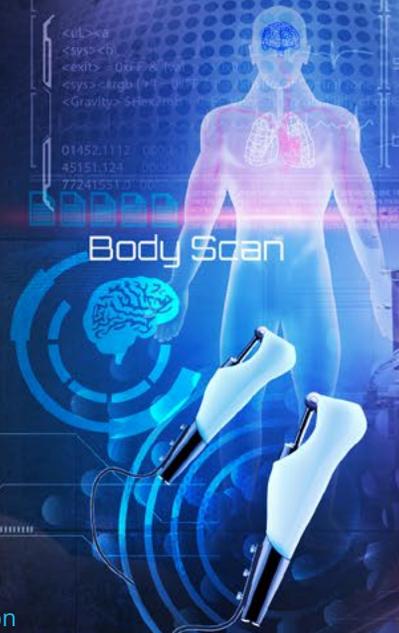
INTEGRATED
CAD, CAE, AND CAM

CAD applications can now include natively integrated modules for computer-aided design, engineering, and manufacturing. No recreating or retranslating data. CAD software like Creo works seamlessly with all the other tools and add-ons design engineers need. Everything is integrated, as a single digital thread weaves its way through the entire design environment.

Creo has powerful, integrated manufacturing capabilities, for both additive and subtractive manufacturing. Your models may involve 5-axis milling, turning, EDM, sheet metal cutting or progressive dies. Creo can easily handle all of these operations, to help turn your designs into reality.

"**Creo is not just a CAD system.** We have a lot of connection points into our manufacturing process, into our presentation process. So we sell our products supported by PTC, we manufacture those products supported by PTC, and at the end, **PTC is visible everywhere.**"

KHS
German Manufacturer of Filling Equipment

ptc.com

SEAMLESS MULTI-CAD

Just because you love your CAD system, doesn't mean your suppliers use it. Or your customers. Or that startup your company just acquired. For these and many other reasons, design engineers encounter non-native CAD files regularly—it's just part of the job.

The good news is recent advances lighten the burden of integrating outsider files into the CAD system of your choice. Advances like Creo's Unite technology make importing, opening, fixing, updating, and saving other CAD files seamless. You don't even need those systems' licenses to use it.

Best of all, this same functionality enables companies to easily consolidate to a single CAD solution, saving money and training time. Collaboration with suppliers, partners, and even other teams can now proceed with ease, no matter the file format.

> "We needed to integrate the ideas from multiple disciplines into one digital design. Unite Technology allowed us to **seamlessly incorporate CAD files from numerous sources,** which made it possible for us to **accept changes from suppliers or re-purpose the data ourselves.**"

SRI International
Non-profit American Research Institute

EFFECTS DATA

```
10 BASE = 32768    32
20 READ BYT
30 IF BYTE =     THEN BASE = BASE -  : GOTO 999
40 POKE BASE   BYTE
50 BASE = BASE + 1
60 GOTO 20
999 IF BASE = (50 + 32768) THEN SYS(32768 + 32)  END
1000 DATA 120
1010 DATA 169  128
1020 DATA 141  31, 3
1030 DATA 169   5
1040 DATA 141, 20, 3
1050 DATA 88
1060 DATA 96
1070 DATA 238, 32, 208
1080 DATA 76, 49, 234
1100 DATA -1
```

creo®

Creo is the 3D CAD solution that helps you accelerate product innovation so you can build better products faster. Easy-to-learn Creo seamlessly takes you from the earliest phases of product design to manufacturing and beyond. You can combine powerful, proven functionality with new technologies such as generative design, augmented reality, real-time simulation, additive manufacturing and the IoT, to iterate faster, reduce costs and improve product quality. The world of product development moves quickly, and only Creo delivers the transformative tools you need to build competitive advantage and gain market share.

WHERE TO START?
EXPLORE CREO.

Go from the earliest phases of design to a smart, connected product with Creo. And with cloud-based augmented reality in each seat of Creo, you can collaborate with anyone, instantly at any step in the product development process. In the fast-changing world of the Industrial IoT, no other company can get you to substantial value as quickly and effectively as PTC.

GROW WITH CREO

Creo has leading capabilities, including those explored in this eBook, at affordable prices whether you're a small business making widgets, an ambitious entrepreneur looking to grow fast, or among the largest of organizations creating the biggest products. Creo is widely used in many industries, from aerospace to health care to consumer goods. No matter your industry or size, with the Creo Design Packages, now Creo can scale up as you do.

START MY TRIAL TODAY >>

Please visit the **PTC support page** for the most up-to-date platform support and system requirements.

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