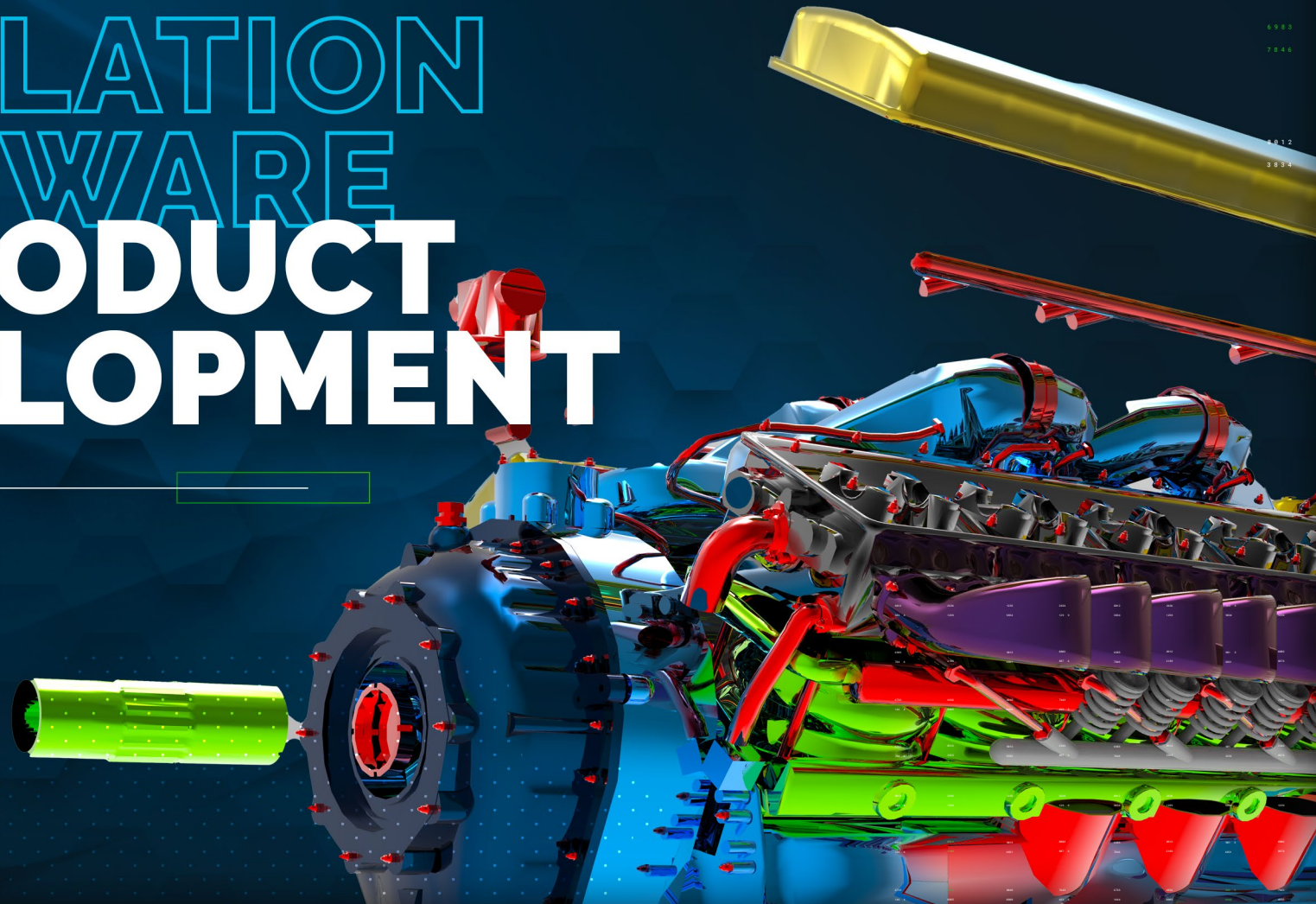# creo®

USE OF SIMULATION SOFTWARE
IN PRODUCT DEVELOPMENT

ptc
DIGITAL TRANSFORMS PHYSICAL

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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.

Simulation is a necessary part of the product development process and in recent year the conversation around "Democratizing Simulation" has empowered non-CAE experts to perform simulation in any stage of product development. We've also seen that simulation is being used earlier on in the process since up to 80 percent of a product's total cost is committed at the early design stage. Launching a design down the wrong path without using the aid of simulation tools could spell financial disaster.

Thanks to today's robust yet user-friendly software tools, performing basic simulation is becoming increasing- ly safe, reliable, and effective, even for non-experts. These applications allow models to be evaluated from the outset to ensure that designs are headed in the right direction. What's more, embracing this practice in no way diminishes the critical role that CAE experts play. One could argue, in fact, that democratizing simulation frees the experts from the burden of basic simulations to concentrate on high-value or complex analysis thus increasing their value to the organization.

The benefits to manufacturers and product development organizations are both measurable and well documented:

> Early design validation eliminates time and cost over-run

> Innovation is advanced through the ability to evaluate more design alternatives

> Removing basic analysis from the role of the CAE experts al-lows them to focus on more complex simulations or projects of higher value to the company while many more non-experts are empowered to perform routine simulations.
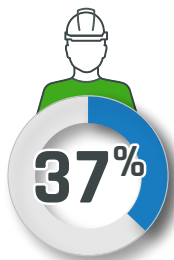
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REVOLUTION in simulation
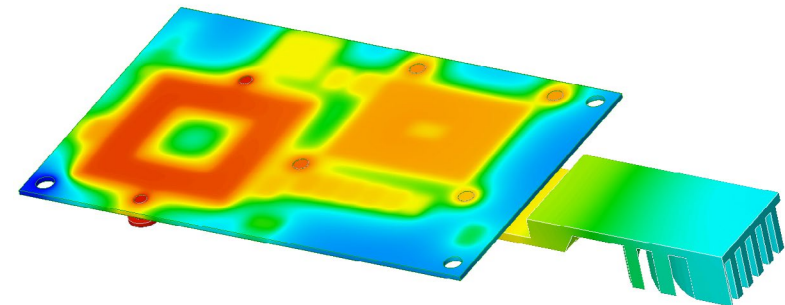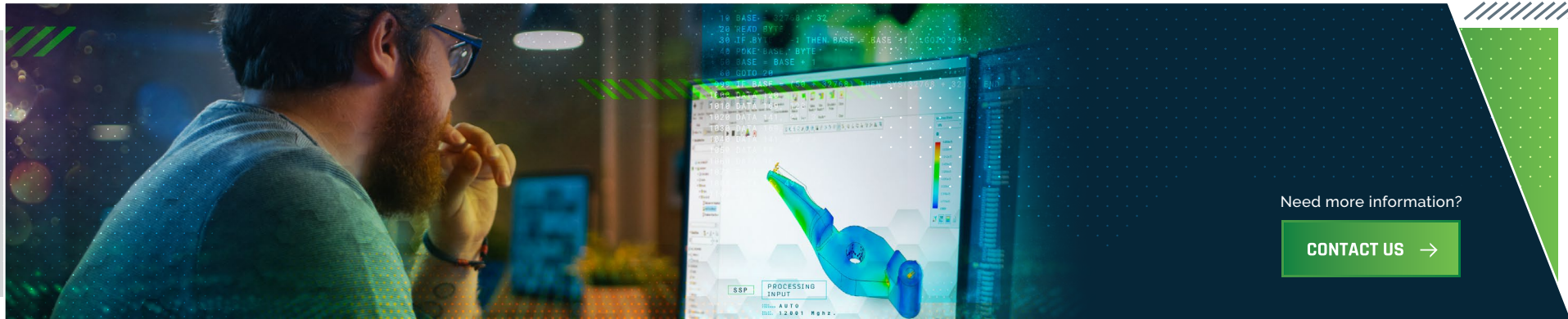
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Survey Respondents

ranged from company Presidents, CIOs, and Directors, to Engineers, Senior Analysts, Product Managers, R&D Managers, Designers, and more.

93% Respondents find that simulation/analysis software allows you to identify potential problems with the design before physical prototypes are built

37%

Were analysts who conduct simulation and analysis studies to verify and optimize designs created by design engineers.

28%
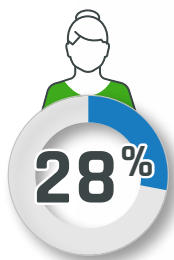
Were design engineers who draft design concepts and build CAD models. This group was also responsible for all simulations and analysis of the designs they create.

21%
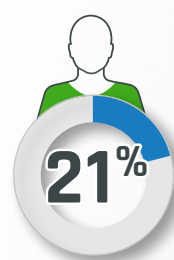
Were designers who create and then pass CAD models along to the CAE-experts for analysis and simulation.

How comfortable are you with running full fidelity simulations on CAD models?

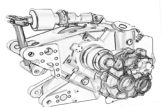**51%** | VERY COMFORTABLE

40% | SOMEWHAT COMFORTABLE

8% | SOMEWHAT UNCOMFORTABLE

2% | VERY UNCOMFORTABLE

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REVOLUTION in simulation

What type of analysis do you perform?

Analysis	Percentage
Static Structural Analysis	87%
Fatigue Analysis	64%
Modal Analysis	63%
Steady State Thermal Analysis	47%
Computaional Fluid Dynamics	44%
Linear Contact Analysis	41%
Tolerance Analysis	36%
Mold Filling Analysis	21%
Human Factor Analysis	13%

During what product development phase is simulation used?

Concept **>>** Design **>>** Validate/Optimize **>>** Prototype **>>** Manufacturing
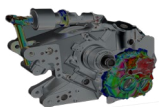
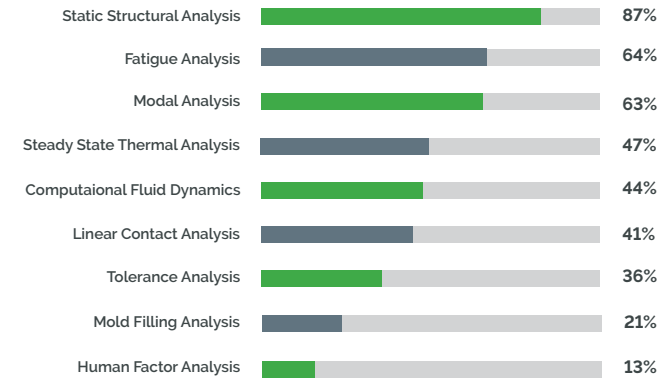**19%** During the initial concept phase

35% During the detailed design phase

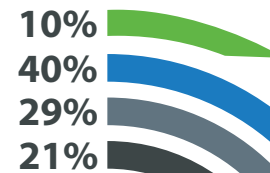**12%** After prototype physical testing has begun, to test failure modes

22% When failures are reported in the field

56% All of the Above

At what stage do you scrap a design and restart?

10%
40%
29%
21%

> **10%** scrap an existing design, When the mathematical calculations prove that a 2d drawing might not be a viable way to move forward.

> **40%** indicated that such steps are taken when potential issues are found by simulation/analysis studies that are run on the CAD designs.

> **29%** say that they restart a design in all such instances.

> **21%** restart a design when physical prototypes fail.

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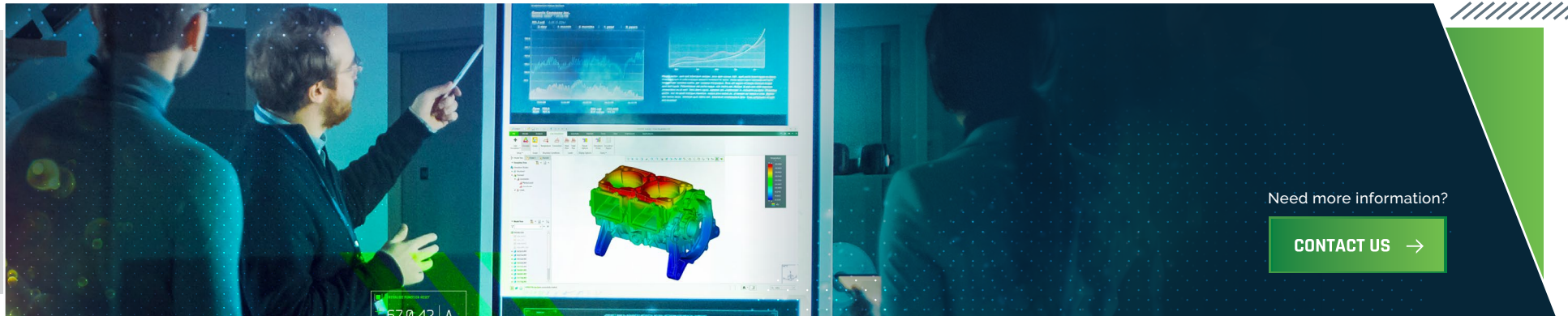
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What best describes your organization's simulation/ analysis tools?

28%
CUSTOM SIMULATION TOOLS BUILT INTO 3D CAD SOFTWARE

34%
CUSTOM SIMULATION TOOLS NOT BUILT INTO 3D CAD SOFTWARE

48%
NON PTC VENDOR SOFTWARE - DOES WORK WELL

26%
NON PTC VENDOR SOFTWARE - DOES NOT WORK WELL

Interoperability is a concern!

Well over half of the companies indicated that they have custom built CAE/ Simulation applications. Many also use commercial tools. Of the group using vendor-supplied applications, 26% said that these tools do not work well with their 3D CAD systems meaning that too many files need to be converted between the systems. This indicates that there is room for improvement for vendors who are not integrating these tools into their cad system.

56% of survey takers said that their company is – or has in the past – explored the opportunity to empower designers and other non-experts to perform simulations. And half of these companies are doing just that.

Complexity is a concern!

When asked if the difficulty and time needed to accurately create and run complex simulation models limits the use of simulation in the product development process just over half (54%) said that it did. About that same number indicated that the use of simulation within their company was limited to the CAE experts. This indicates that the complexity associated with simulation, real or perceived, remains an obstacle to democratizing simulation. Here, in their own words, is a sample of explanations for why companies who have investigated this have chosen not to implement the democratization of simulation.

Need more information?

"REASONS WHY COMPANIES HAVE CHOSEN NOT TO IMPLEMENT SIMULATION - LED - DESIGN:

THE EXPENSE TO DEMOCRATIZE WAS EXCESSIVE.

LESS KNIOWLEDGE OF SIMULATIONS.

DON'T KNOW HOW TO USE IT AND DON'T WANT TO BE RESPONSIBLE FOR ITS USE.

LACK OF TRAINING AND GROUND RULES.

CURRENTLY ALL PEOPLE RUNNING SIMULATION ARE EXPERTS.

DON'T HAVE THE TOOLS OR HAVE NOT BEEN REQUESTED TO DO SO.

DESIGNERS ARE BUSY WITH "DESIGN FOR MANUFACTURING" TOPICS.

CONCLUSIONS

It's safe to say that simulation-led-design has progressed from infancy to an "adolescent" stage. While democratization tools have steadily matured, there remains a need for them to become even more interoperable and user-friendly. Many vendors are addressing such issues with partnerships and by investing more in their own development.

Many industry analysts, reporters, and others with a finger on the pulse of the industry agree that simulation-led-design, like other changes, can be uncomfortable. Likewise, companies that invest heavily in their CAE resources and tools may baulk at paying once for the non-expert designer-level simulations and then again for the experts to perform a final validation.

It is fair to say that resistance to this inevitable change will be short-lived as companies heavily investing in simulation-led-design begin to gain the upper hand. Organizations like CIMdata continue to highlight simulation-led-design's significant contribution to innovation and the related increase in market share. By moving simulation further upstream into the hands of non-experts in the product teams, to evaluate multiple design concepts and optimize performance, these companies get a leg up on their competition and stay ahead of market needs and trends.

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