engineering.com

Research Report: Integrate Design and Simulation with Cloud-based Solutions

This research has been sponsored by Dassault Systèmes.

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EXECUTIVE SUMMARY

Many CAD and CAE software developers propose that the promise of simulation—to get products to market better and faster—can only become reality when design and analysis are integrated throughout the development cycle. The idea is that simulation-led design, or integrated modeling simulation (MODSIM) strategies, can streamline the development process while simultaneously producing more optimized products.

To understand these ideas, engineering.com conducted a survey to learn more about the role simulation plays in development cycles.

- Does your company integrate design and analysis functions?
- What design and analysis tools do you use?
- How are designs validated?
- How do teams communicate?
- How many iterations does a product go through?

These questions and more are the focus of this report. The aim is to understand how companies are using MODSIM strategies to reduce development cycles.

Thanks to all our survey participants for sharing their experiences, and thanks to you for reading.

Sincerely,
Shawn Wasserman
Senior Editor, engineering.com

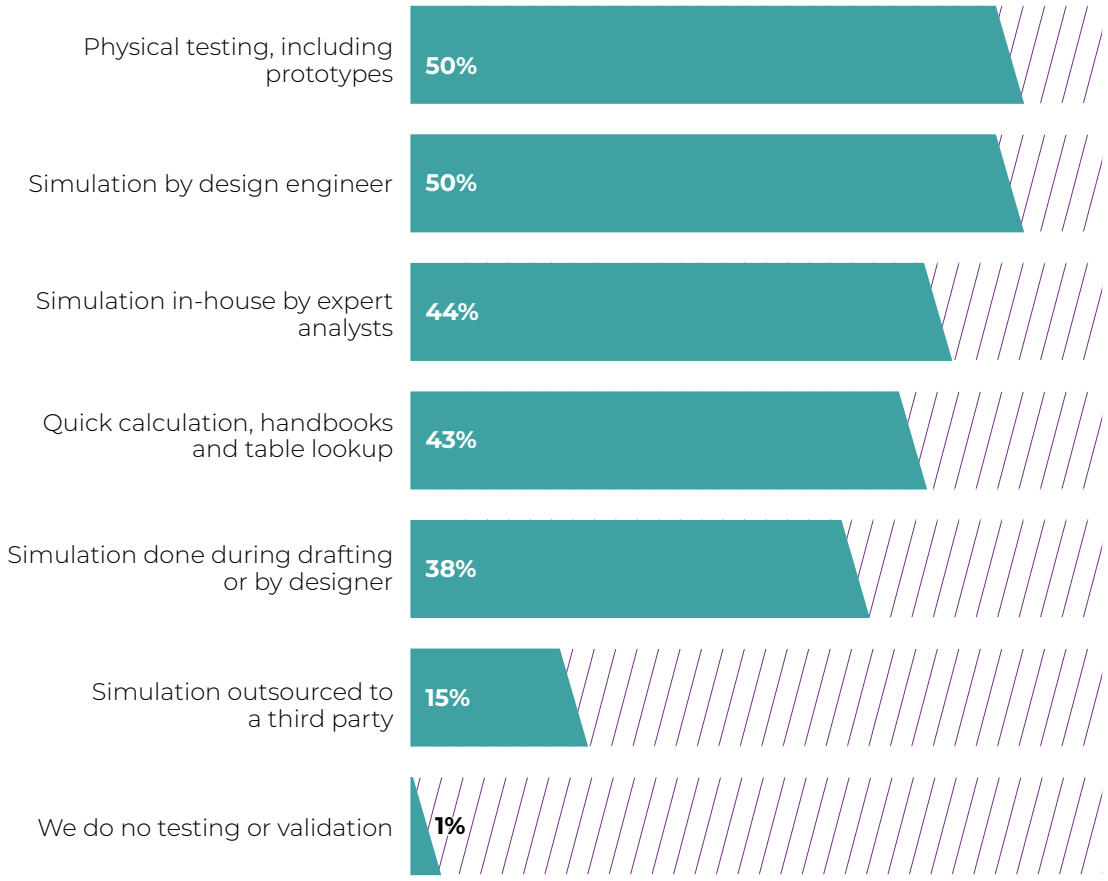
Is MODSIM Replacing Physical Prototypes?

DATA VALIDATION TRENDS

We asked users how they typically validate their designs and found that half of respondents use simulations that are validated by the design engineer. Additionally, in-house simulations, completed by analysts, was selected by 44% of respondents.

On the other hand, half of respondents still invest in physical testing and prototypes to validate their designs, while 43% use quick calculation, handbooks and tables.

Since physical prototypes are costly and time consuming, this suggests that there is room in organizations to streamline the processes between design, validation and iteration by utilizing MODSIM strategies. This is supported by the fact that only 38% of respondents validate while drafting or during early design.



Q: How do you validate your designs? Select all that apply.
The chart displays the percentage of respondents who selected each option.
Because respondents can select multiple options, the total can go above 100%. N = 290

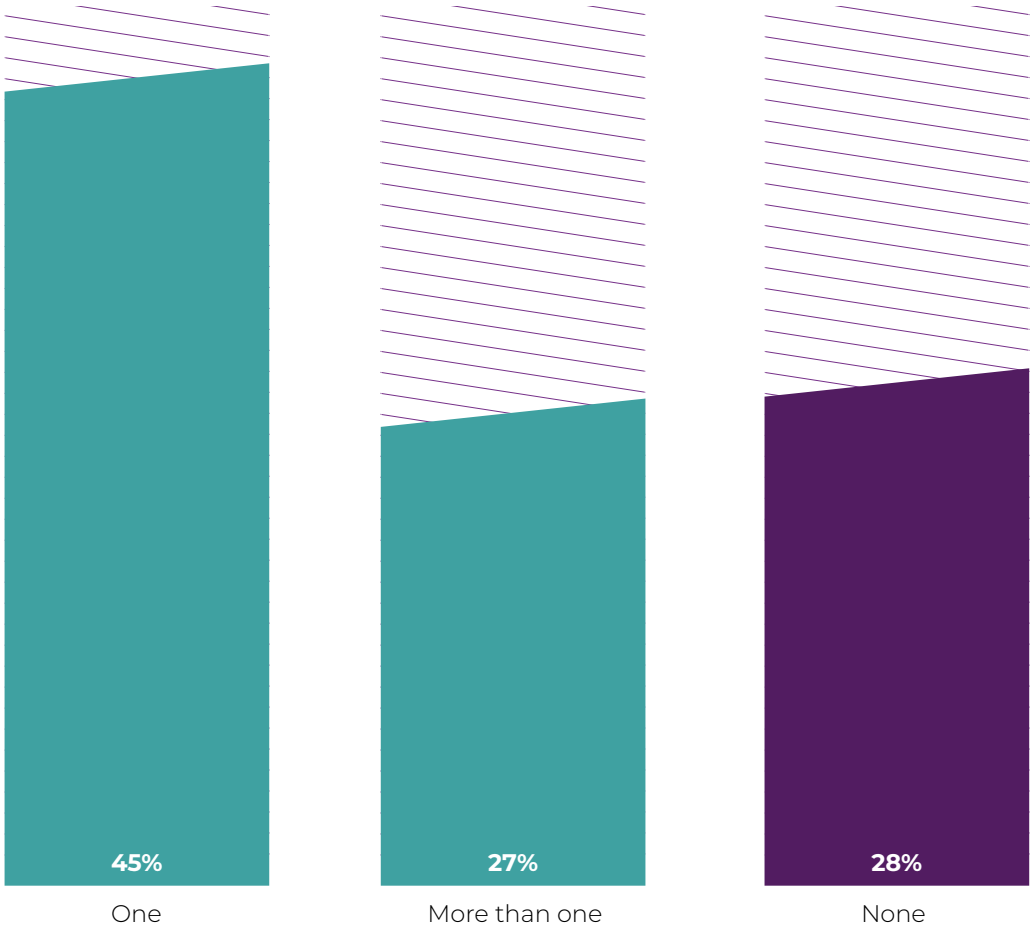
NUMBER OF PHYSICAL PROTOTYPES CREATED BEFORE THE FINAL PRODUCT

Since MODSIM technology can, in theory, reduce physical testing, how many prototypes are engineers working with?

Just under half use a single prototype. This makes sense, as it is often recommended to verify and validate simulations with at least one prototype. And having a single prototype still fits the 'build it right the first time' philosophy of MODSIM and simulation-led design.

However, 27% of engineers create multiple prototypes to achieve their final product design. This suggests that many are not streamlining the iterative process between simulation and design.

Interestingly, 28% of engineers avoid physical prototypes. This suggests they have already validated the simulations, or their products cannot be easily or economically tested.



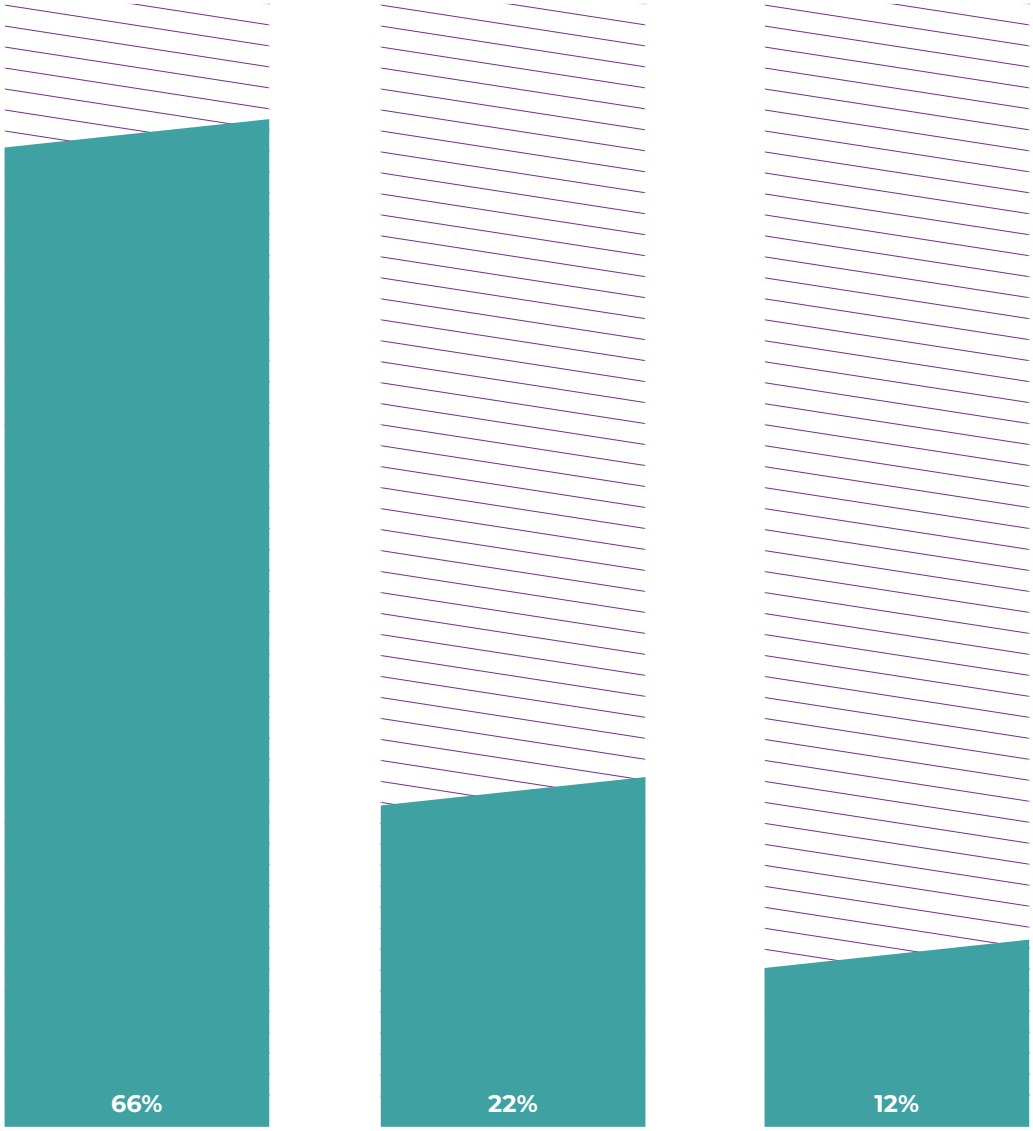
Q: How many physical prototypes do you typically create before finalizing the product design?

N = 285

DO ENGINEERS PREFER TO WORK WITH PROTOTYPES OR SIMULATIONS?

The previous prototype and simulation usage numbers are supported by the preferences of engineers. Most respondents (66%) are interested in running more simulations over creating prototypes.

Still, 22% want to create more physical prototypes and 12% are satisfied with their current strategies. Though some of that 12% will be using MODSIM already, these numbers (and some statistics to come) suggest that the 'this is how we always do things' mentality still exists in the engineering community.



Q: Would you rather do more prototypes or more simulation? N = 209

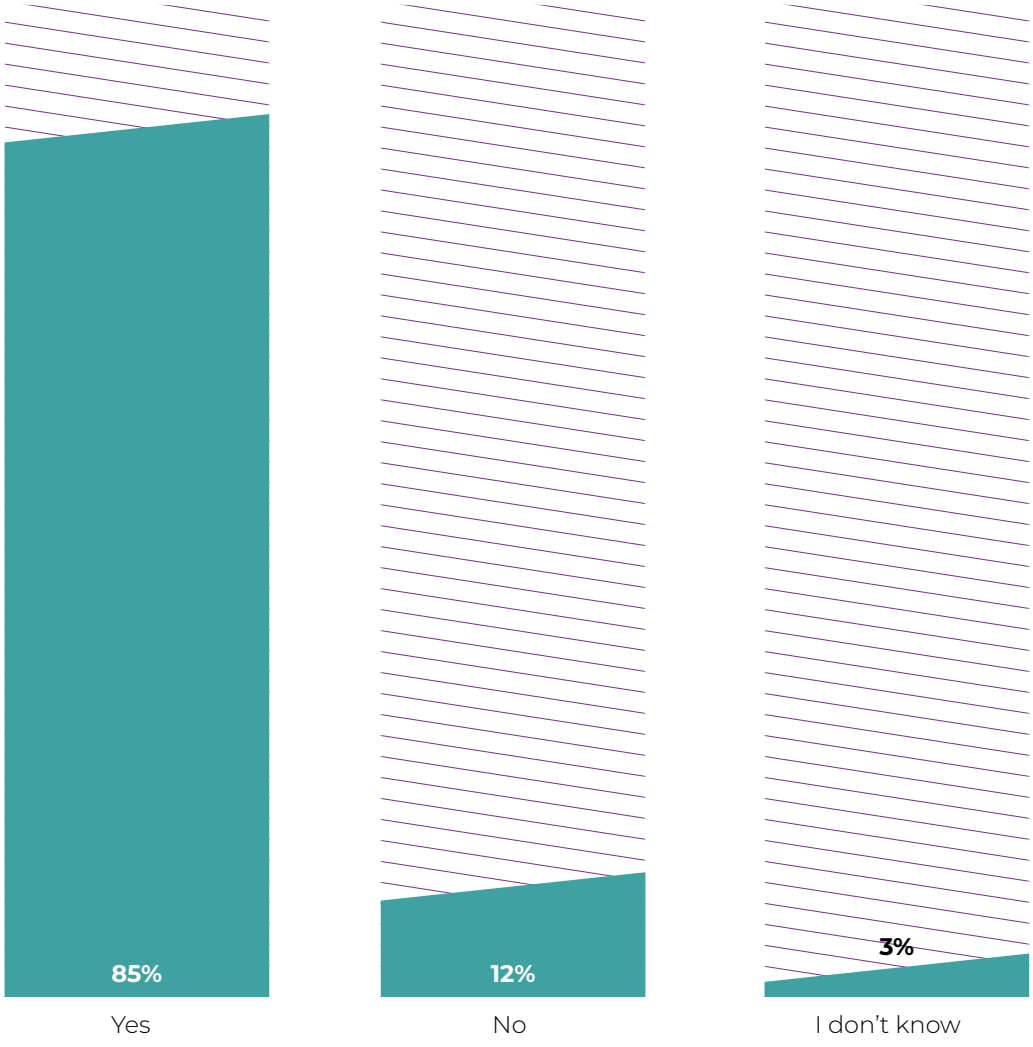
Are MODSIM and Automation Streamlining Design?

DESIGN AND ANALYSIS INTEGRATION

We asked respondents whether their companies intend to integrate their design and analysis processes to improve product development. Potential motives would be to implement a 'build it right the first time' design methodology and to embrace MODSIM or simulation-led design strategies.

The majority (85%) say that they are working to improve this part of product development, while 12% indicate that they are not focusing on integrating simulation with the design iteration process.

This suggests that most organizations are convinced of the benefits of bringing simulation into early development. However, hurdles may still exist.



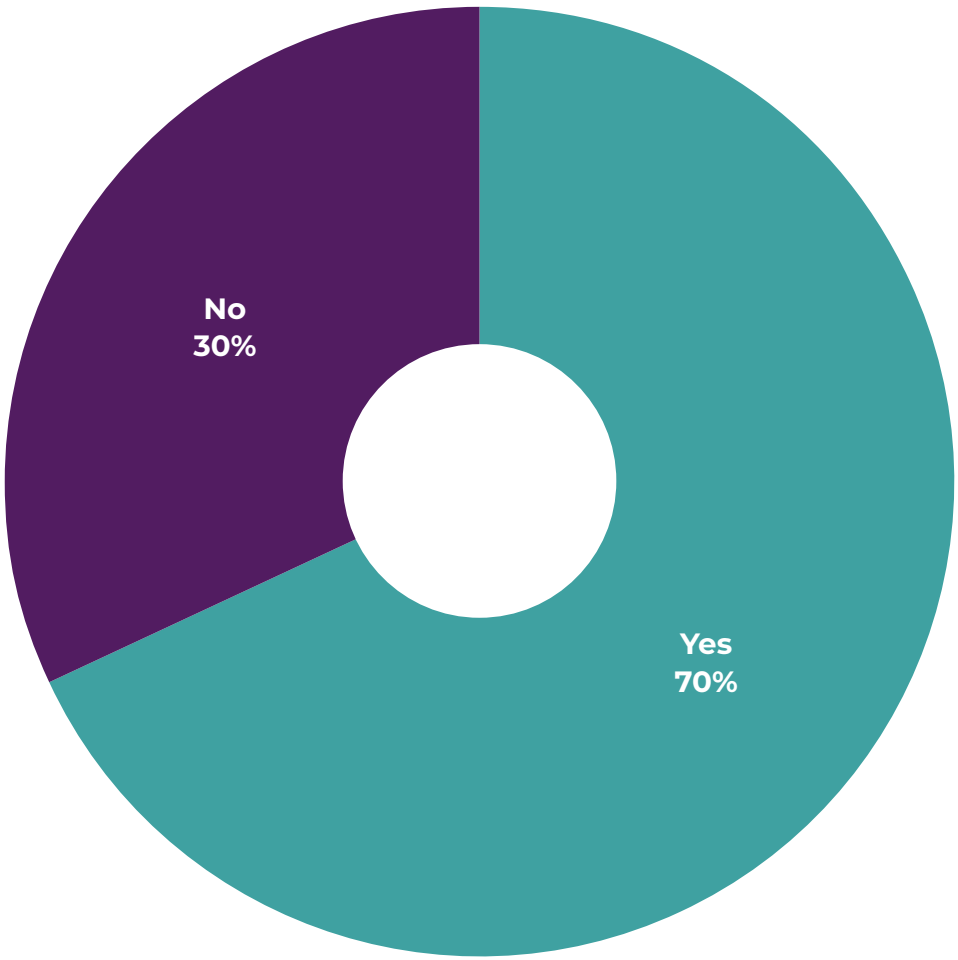
Q: Has your company focused on integrating the design and analysis functions to improve product development?

N = 290

DO YOU USE THE SAME VENDOR FOR MODELING AND SIMULATION?

We wondered if organizations are loyal to the same vendor to support their modeling and simulation work as this might help to streamline the MODSIM process.

We found that the majority (70%) do rely on the same vendor and 30% use multiple vendors.



Q: Are your modeling applications and simulation applications made by the same vendor?

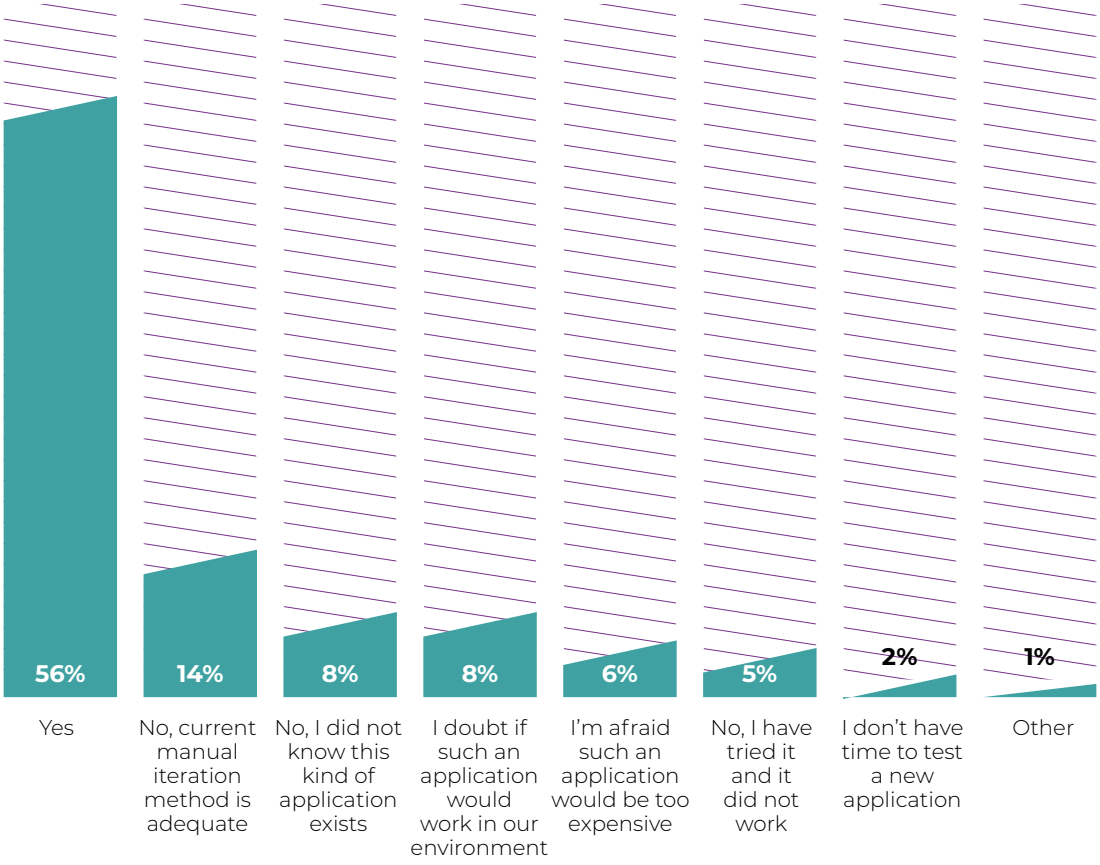
N = 281

DO ENGINEERS AUTOMATE THE ITERATION BETWEEN MODELING AND SIMULATION?

Since the benefits of simulation-led design and MODSIM appear to be generally accepted, do engineers use tools that integrate and/or automate the modeling, simulation and iteration process? The majority (56%) said yes. Tools of this kind include simulation-in-CAD, artificial intelligence (AI), generative design, simulation apps, parameterization techniques and GPU simulation.

However, the remaining 44% cite reasons why they are not automating the bridge between their modeling and simulation work. These reasons include:

- They are satisfied with manual iteration (14%)—or this is how they always do it.
- They are not aware such an application exists (8%).
- They doubt that automation tools are compatible with current setups (8%).
- They believe automation tools are too expensive (6%).
- Their previous attempts were unsuccessful (5%).
- They don't have the time to test new tools (2%).



Q: Do you use an application that iterates automatically between your modeling and simulation application?

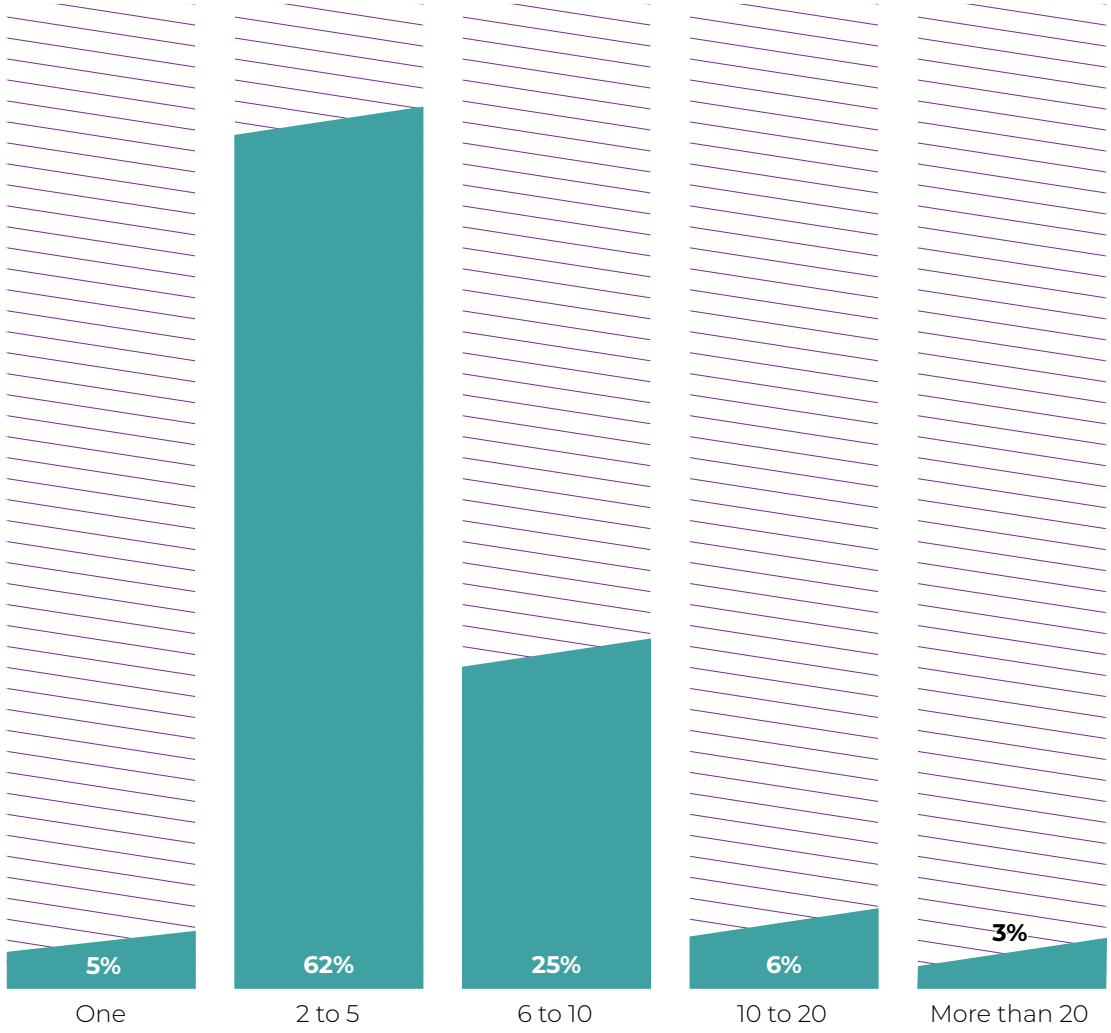
N = 290

HOW MANY ITERATIONS DO ENGINEERS GO THROUGH?

The fact that so few have yet to automate the MODSIM process suggests that many engineers do not work with a lot of design iterations before they get to the final product.

The data shows that this is the case, with 62% indicating that they plan for only 2 to 5 iterations. A surprising 5% are happy to run a design through the engineering process once and move onto the next project. These scenarios likely result in suboptimal designs.

A quarter of respondents run 6 to 10 cycles, 6% iterate 10 to 20 times and 3% iterate over 20 times. To support these numbers, these engineers are likely using MODSIM tools that can streamline design, validation and iteration. The result would be more optimized products.

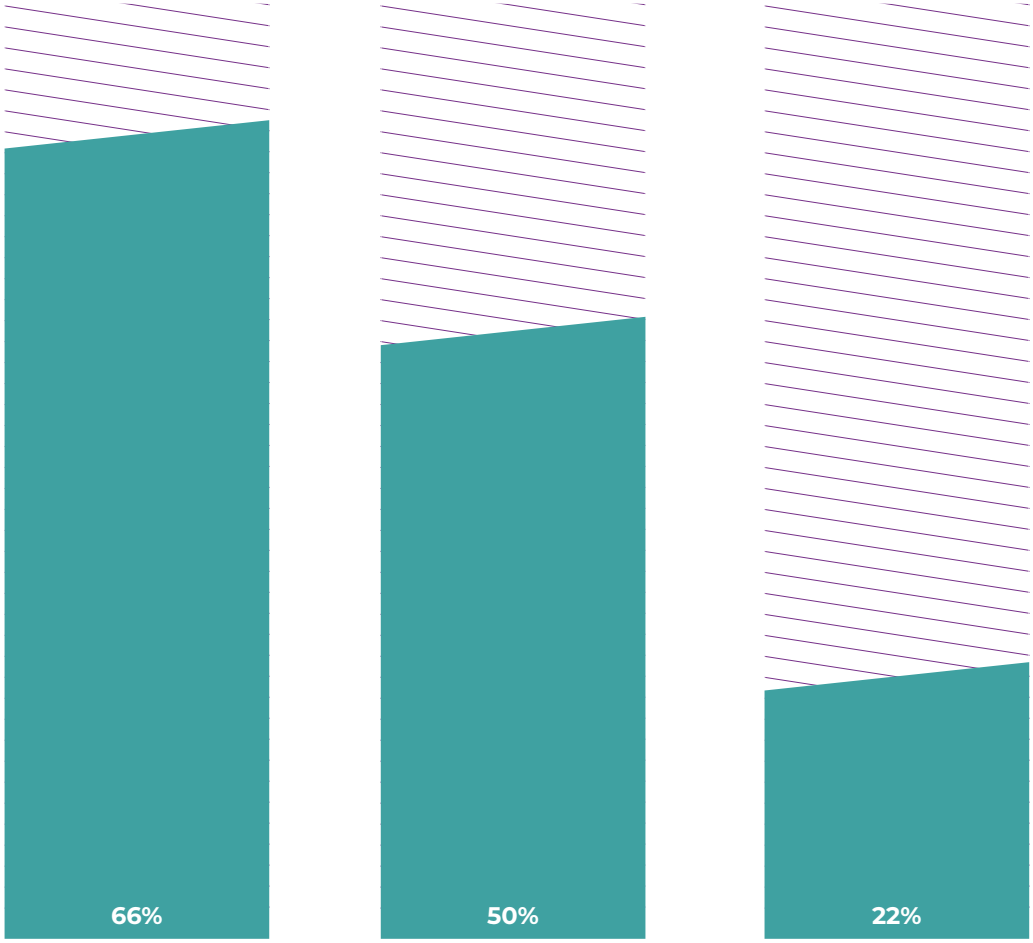


Q: How many times do you iterate between design and simulation? N = 126

WHAT IS HOLDING ENGINEERS BACK FROM DOING MORE ITERATIONS?

Digging deeper, the main obstacles that limit the number of iterations our respondents use are time (66%), cost (50%) and the effort to produce iterations (22%).

This suggests that simulation-led design and cloud-based, MODSIM tools that automate or streamline the iteration process are likely to improve the operations of these respondents. For instance, a tool that meshes a CAD model under the hood, or eliminates meshing altogether, will do much to reduce the time, cost and effort needed to move from one iteration to another.



Time. We are bound by schedule and can only do so many iterations.

Cost. We have limited budget for simulation.

Effort. It's too difficult to go back and forth between models and simulation data.

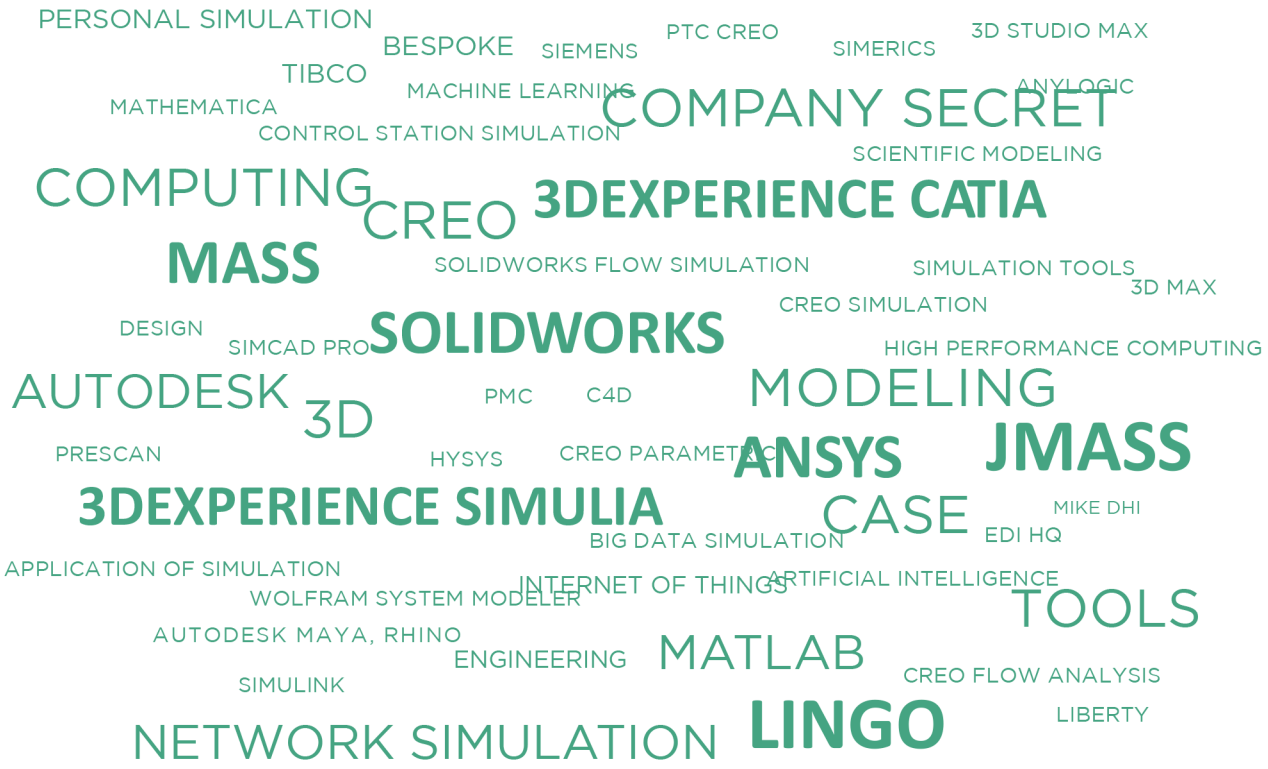
Q: What limits your number of iterations between design and simulation? Select all that apply. The chart displays the percentage of respondents who selected each option. Because respondents can select multiple options, the total can go above 100%. N = 125

What Engineers Want in MODSIM and Simulation-led Design Tools

INTEGRATING MODELS AND SIMULATIONS

Respondents were asked to share which application they use to integrate their models and simulations. A shocking 12% mentioned that their organization developed proprietary software. Others cited the use of tools that would require a lot of hands-on work, such as MATLAB (8 responses), JMASS (6 responses) and LINGO (6 responses).

Fewer responded with using tools that are designed to optimize the simulation-led design and MODSIM process. This suggests that engineers would be better equipped to streamline the design, simulation and iteration workflow if they had more access to these tools.



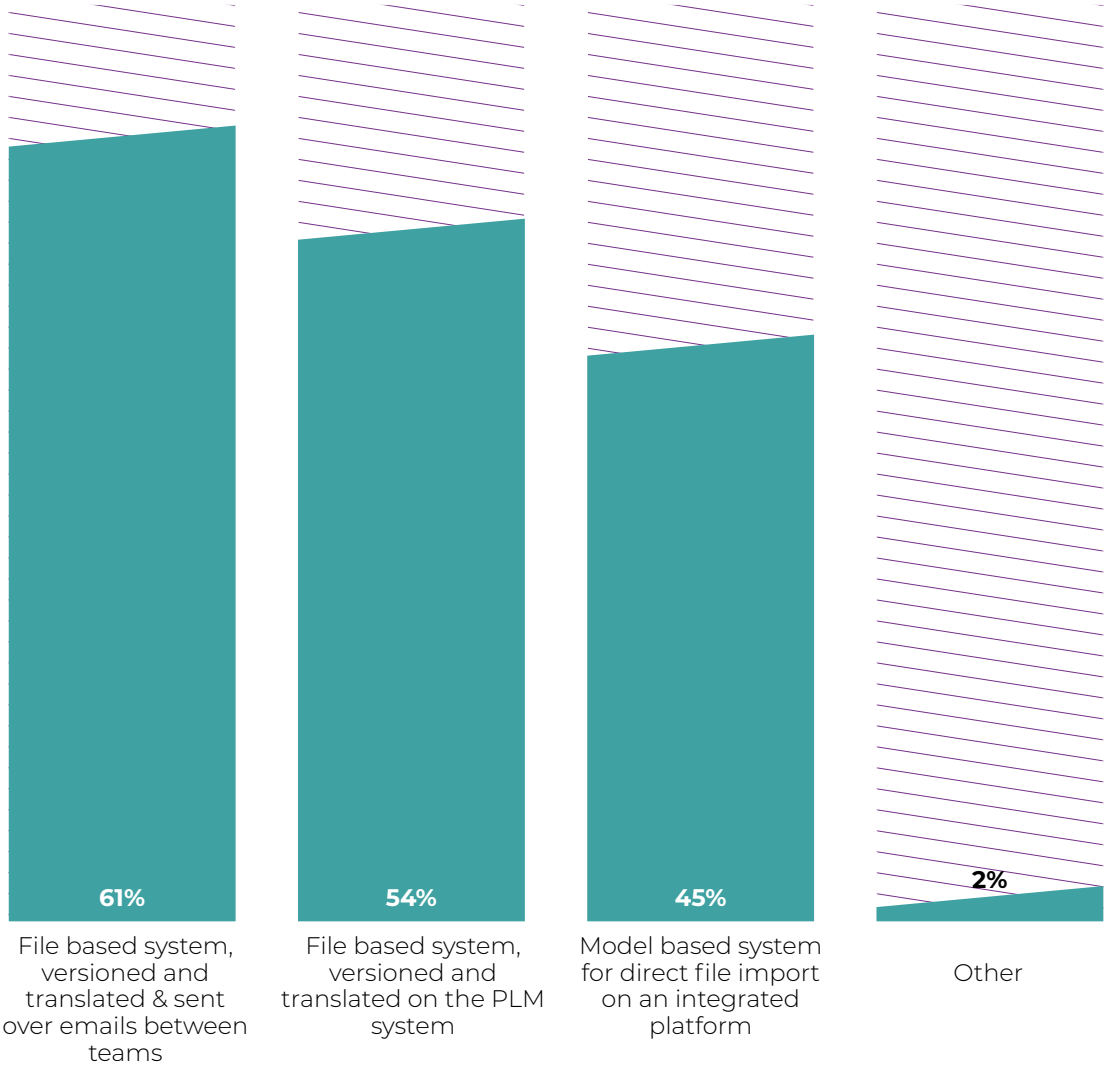
Q: Which modeling and simulation integration application do you use? N = 90

COMMUNICATION TOOLS BETWEEN DESIGNERS, ANALYSTS AND ENGINEERS

We sought to discover how designers, analysts and engineers communicate to dig deeper into the MODSIM workflows engineers have created. This could help to point towards the lowest hanging fruit to streamline the iterative process between design and simulation.

Of the communications technologies available:

- 61% use a file-based system that is versioned, translated and sent via email.
- 54% depend on a PLM file-based system that is versioned and translated.
- 45% use a model-based system for direct file imports on an integrated platform.

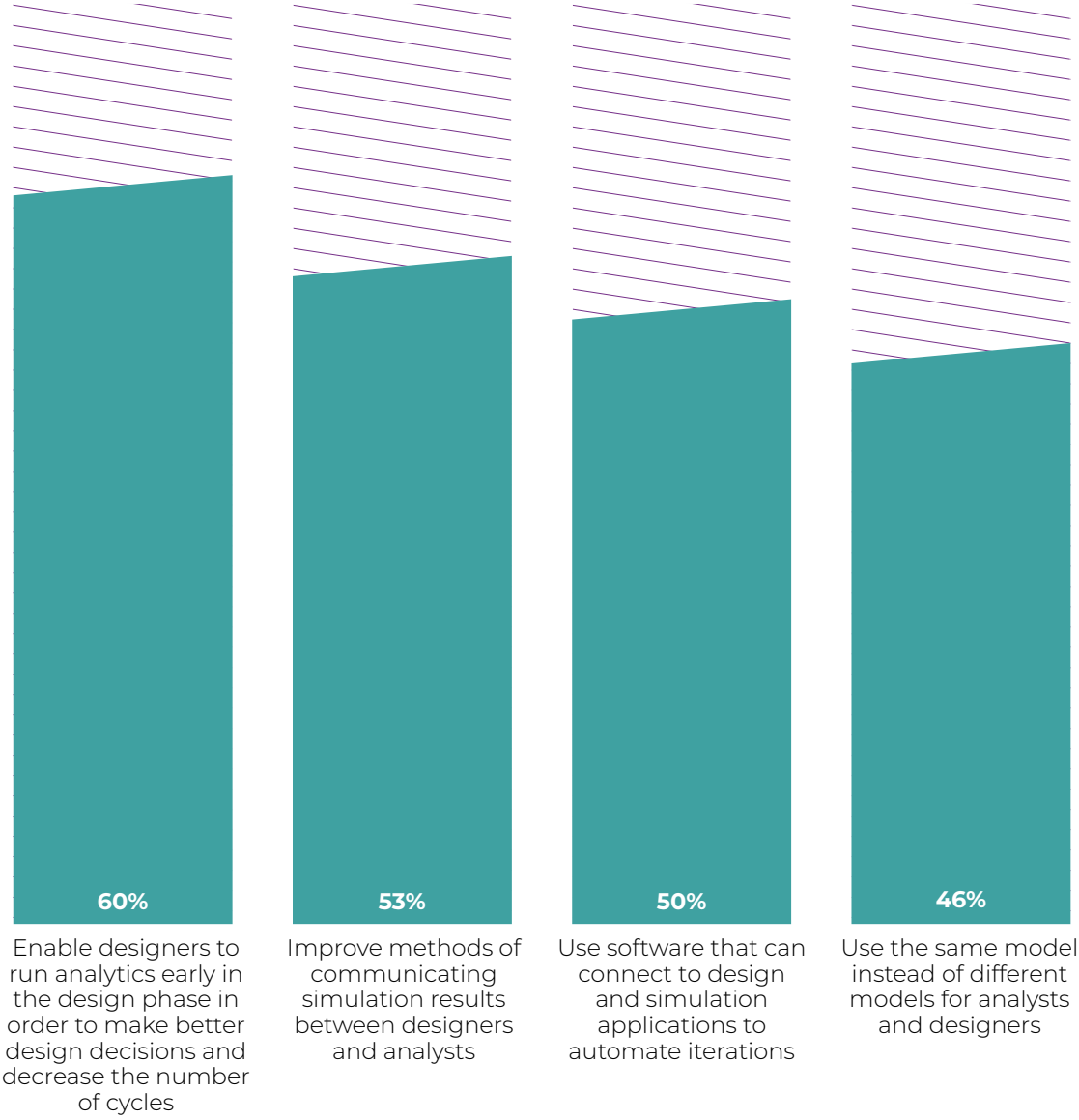


Q: How do your designers, engineers and analysts communicate with each other? Select all that apply.
The chart displays the percentage of respondents who selected each option.
Because respondents can select multiple options, the total can go above 100%. N = 289

IDEAS TO IMPROVE AND STREAMLINE DESIGN AND SIMULATION CYCLES

As for what simulation-led design and MODSIM tools could look like, engineers were asked how they would like to better streamline the simulation and design cycle. The following actions were endorsed:

- Enable designers to run analytics early in the design phase (60%).
- Improve the way simulation results are communicated (53%).
- Connect design and simulation applications with automation software (50%).
- Standardize models for analysts and designers (46%).



Q: What can you do to better streamline design - simulation cycles? Select all that apply.
The chart displays the percentage of respondents who selected each option.
Because respondents can select multiple options, the total can go above 100%. N = 289

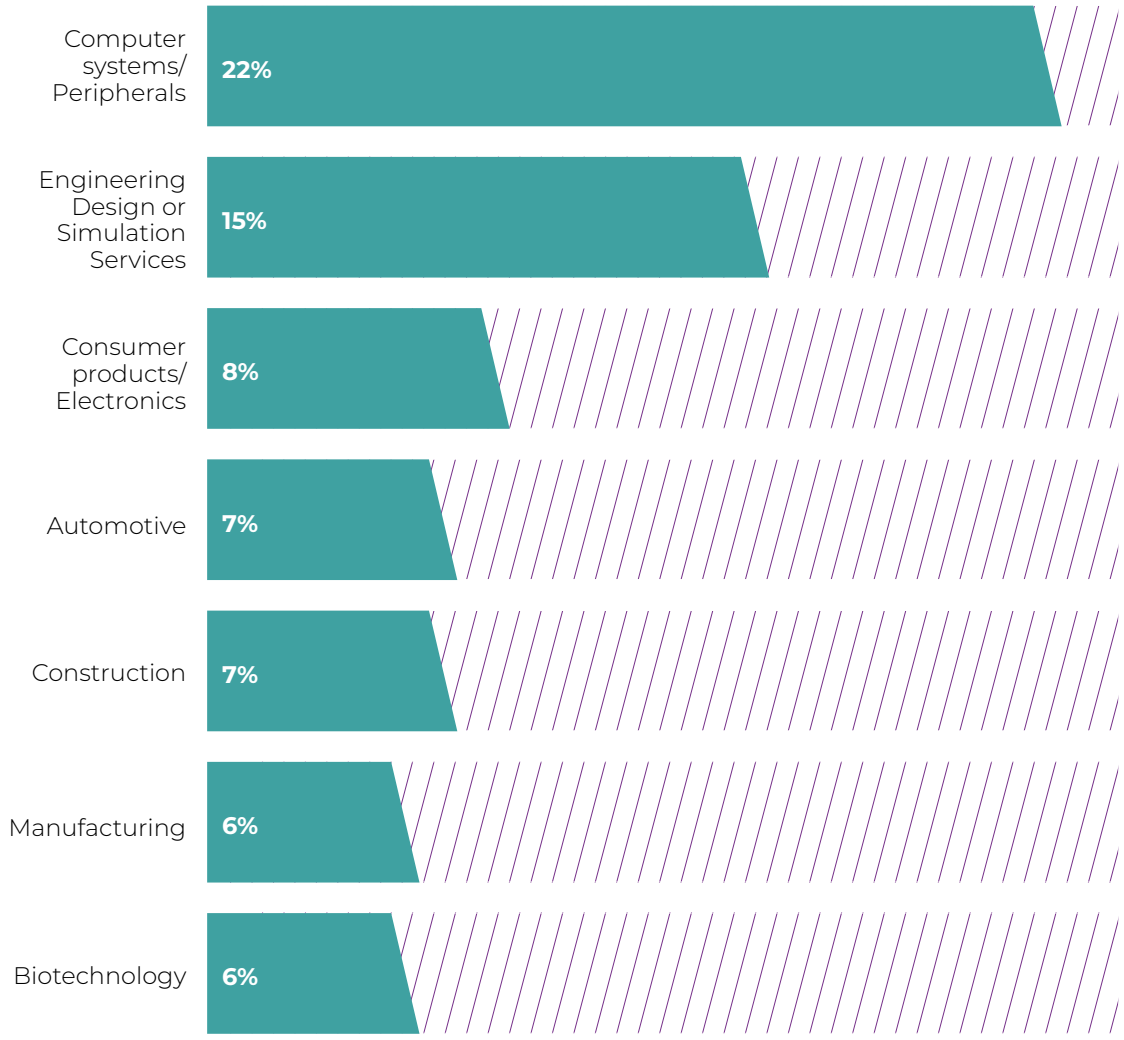
General Demographics

INDUSTRIES REPRESENTED

Though respondents work in a diverse range of industries, the largest industries represented here are Computer Systems/Peripherals (22%), Engineering Design or Simulation Services (15%), Consumer Products/ Electronics (8%), Automotive (7%), Construction (7%), Biotechnology (6%) and Manufacturing (6%).

The following other industries were represented as well by a smaller set of respondents:

- Each representing 4%: Chemicals/Plastics/Rubber; Communications
- Each representing 3%: Food & Beverage; Industrial Machine Tools; Education
- Each representing 2%: Aerospace; Medical Equipment/Devices
- Each representing 1%: Oil & Gas; EDA; Government; Heavy Equipment; Mining



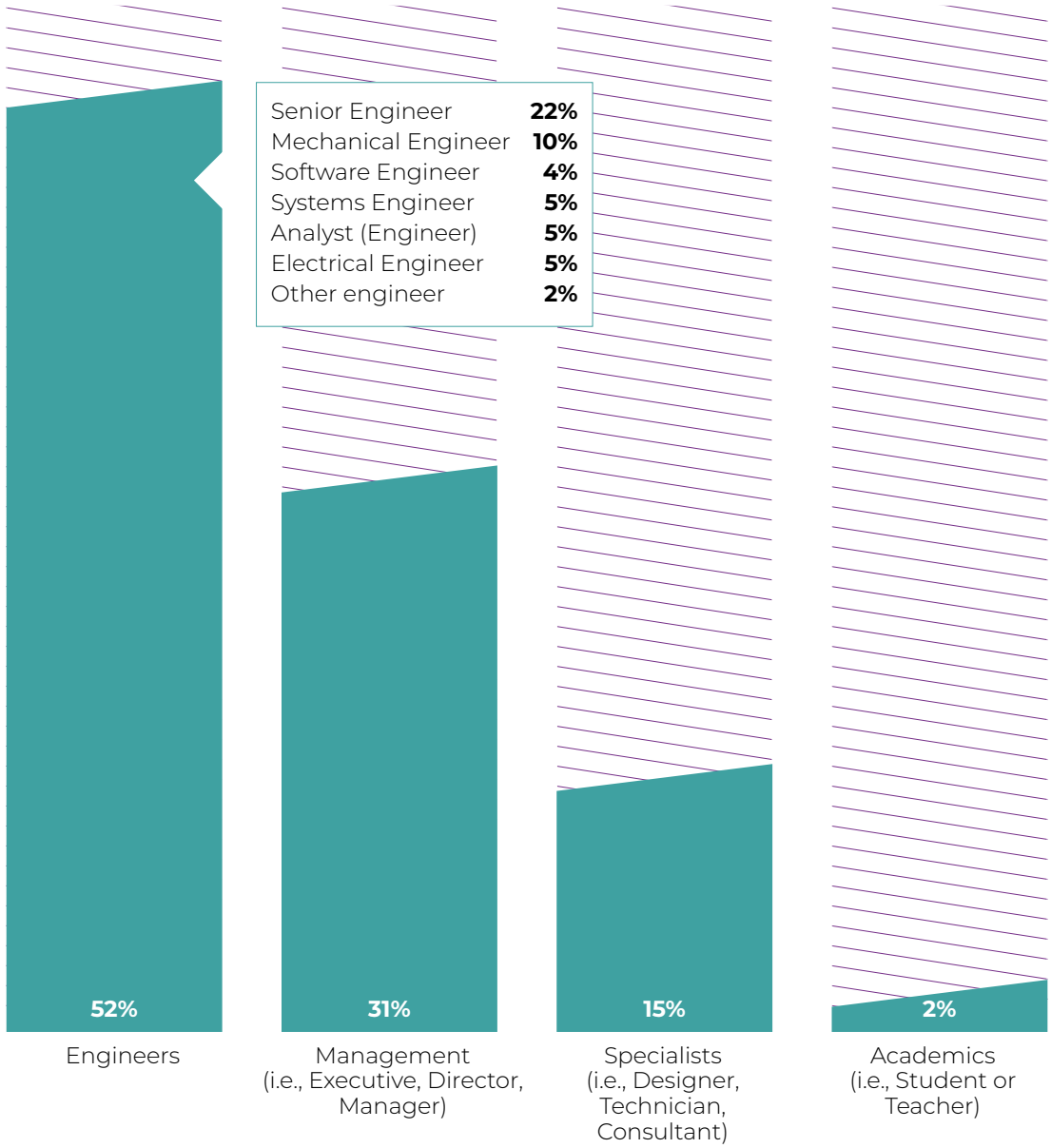
Q: What industry do you work in?
[Chart showing industries with 5% or more respondents]

N = 289

JOB ROLES REPRESENTED

More than half of respondents included in this survey are Engineers (52%). Of those, 22% are Senior Engineers, 10% are Mechanical Engineers, Software Engineers (4%), Systems Engineers (5%), Analyst Engineers (5%), Electrical Engineers (5%) or fit into another engineering role (2%).

Out of the remaining 48% of respondents, 31% work in management, 15% are specialists (i.e., designers, technicians and consultants) and 2% are in academia.



Q: What is your job role?

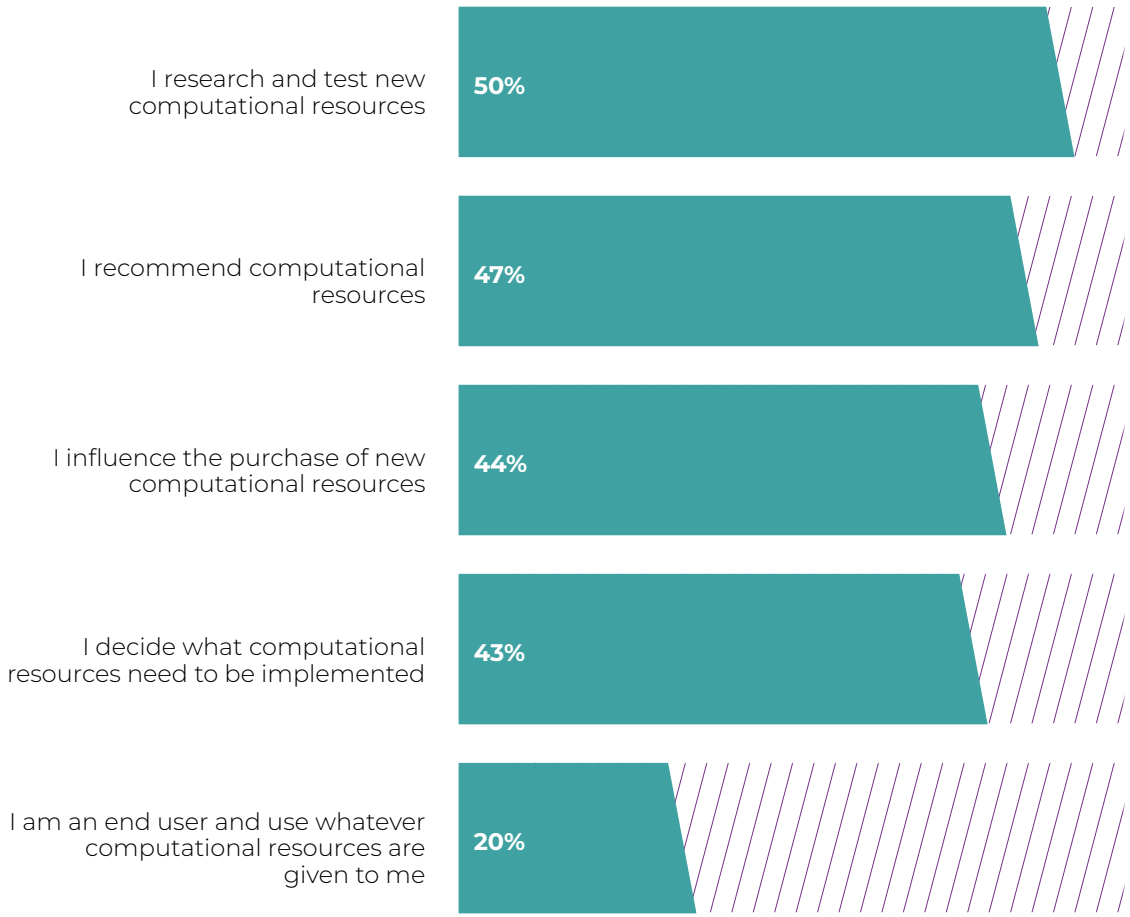
N = 287

WHAT ROLE DO RESPONDENTS' PLAY IN SECURING COMPUTATIONAL RESOURCES?

This report includes responses from individuals who are responsible for researching and testing new resources (50%), those who recommend computational resources (47%), those who influence the purchasing decisions (44%) and engineers who make the final decision for their organizations (43%).

In many cases, one individual can serve in multiple capacities to locate, vet and determine what will work best for their organization.

Of our total group surveyed, 20% consider themselves to be end users.

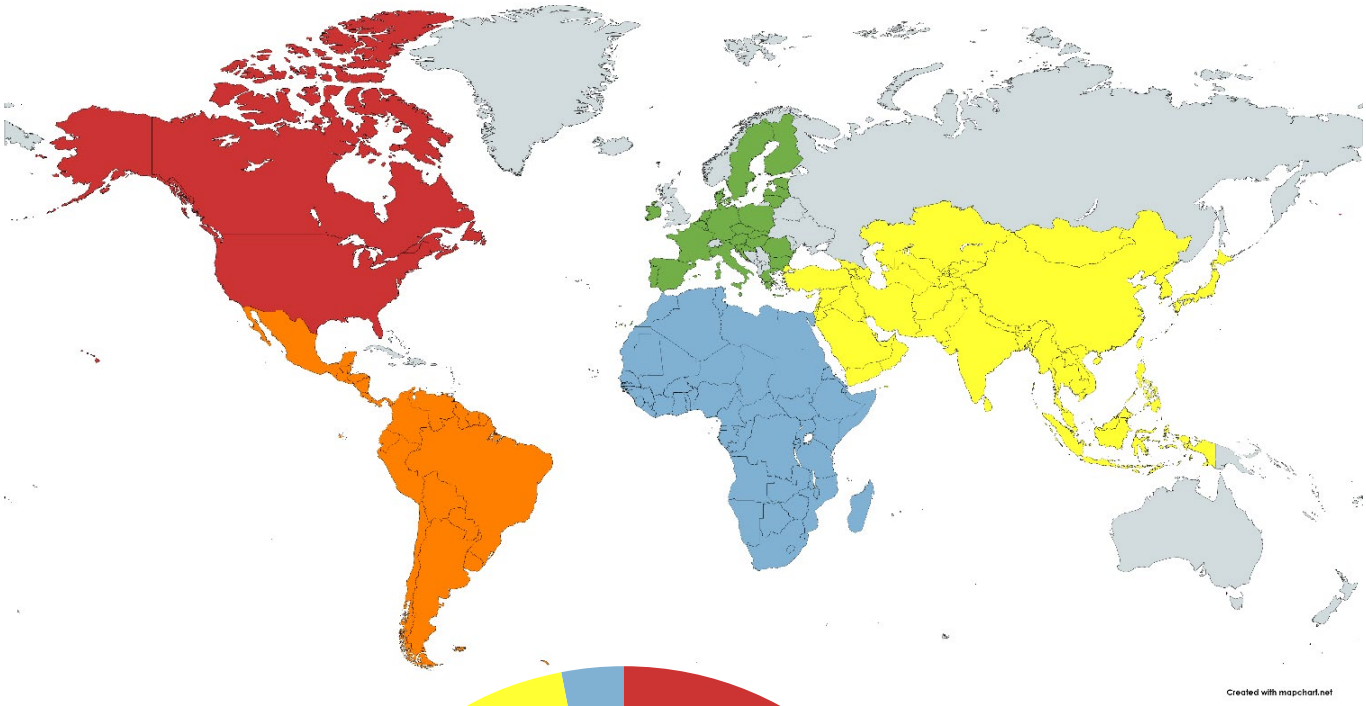


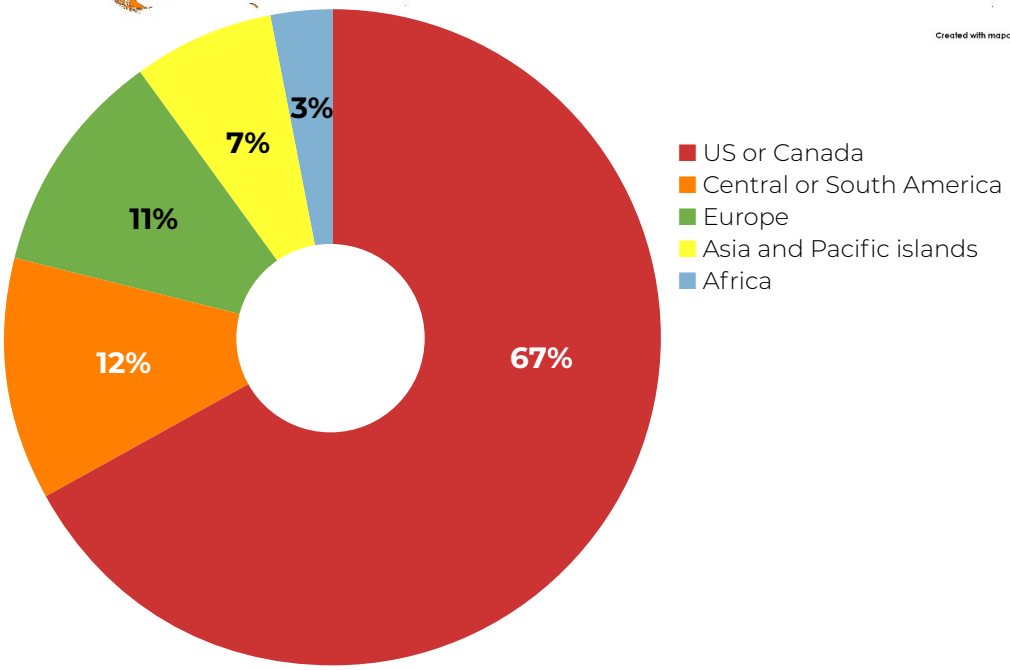
Q: What role do you play when it comes to computation resources? Select all that apply.
The chart displays the percentage of respondents who selected each option.
Because respondents can select multiple options, the total can go above 100%. N = 290

GEOGRAPHIC LOCATION

This report pulls feedback from engineering professionals around the globe.

Most respondents (67%) live in the U.S. or Canada, some are in Central or South America (12%), and there is also some representation from Europe (11%). Asia, the Pacific Islands (7%) and Africa (3%) represent the remainder of respondents.





Q: Where are you located?

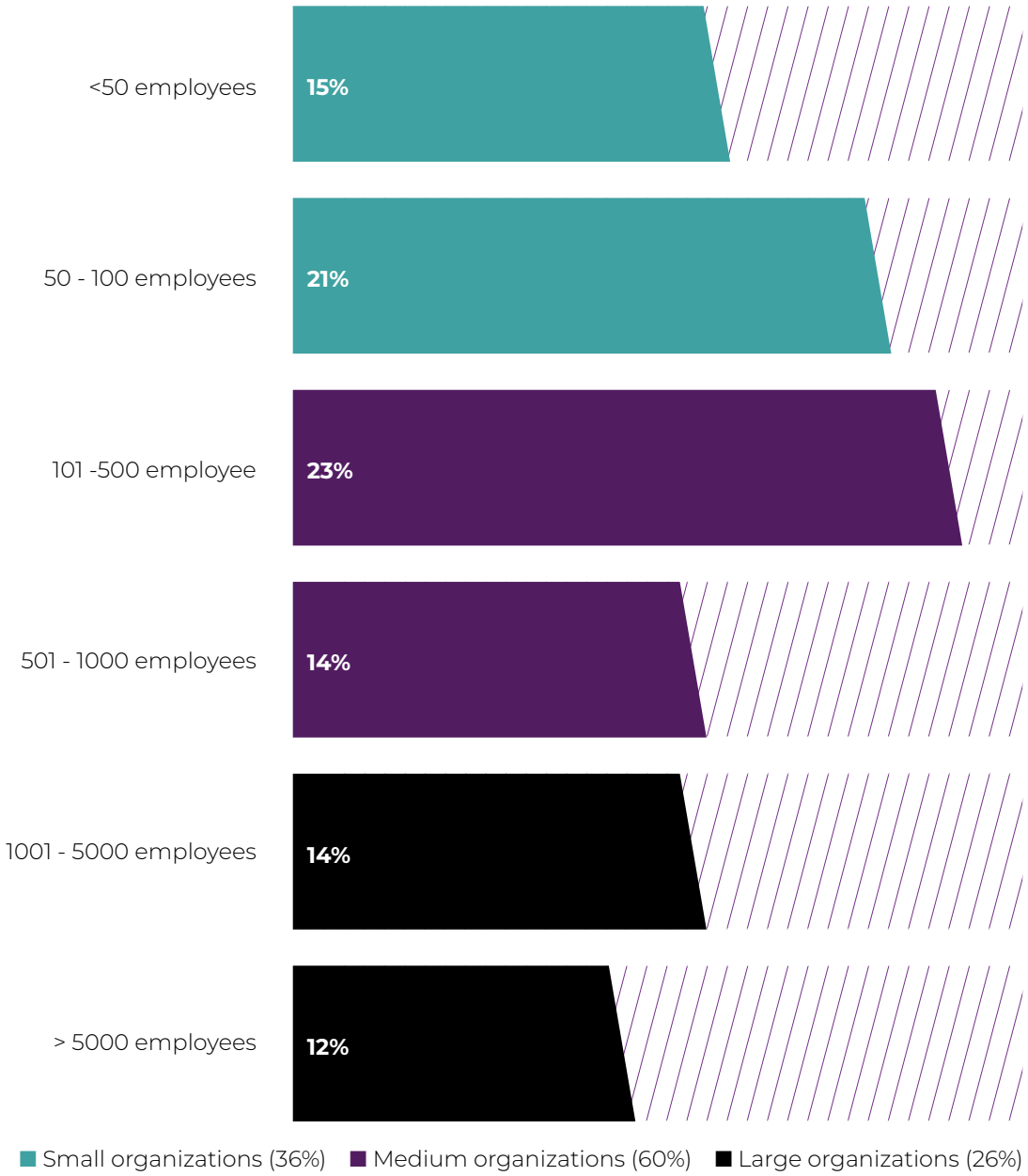
N = 289

ORGANIZATION SIZE

The survey shows that a fair percentage of the respondents (60%) work in mid-sized organizations of 101–1,000 employees.

36% work in small organizations of 100 or less employees.

Finally, 26% of our survey takers are members of large organizations with more than 1,000 employees.



Q: What is the approximate size of your organization?

N = 290

CLOSING COMMENTS

We conducted this survey to find out if companies are embracing MODSIM and simulation-led design strategies throughout the development cycle. To that end, the majority (85%) intend to integrate design and analysis functions, to some degree, to improve product development.

Additional takeaways from the survey include:

- Half of respondents invest in physical testing and prototypes for validation. However, 45% only use one prototype, which fits the MODSIM philosophy. Over a quarter (28%) fully embrace the philosophy and skip prototyping.
- Most respondents (66%) would rather run more simulations than creating physical prototypes. However, just over half (56%) are using MODSIM or simulation-led design tools.
- Two thirds of respondents run through five or less iterations before finalizing a design. Meanwhile, only 9% run 10 or more iterations, suggesting they use a highly automated or streamlined MODSIM process.
- The biggest bottlenecks to simulation-led design implementation is the time (66%), cost (50%) and effort (22%) needed to produce iterations. The lowest hanging fruit for improvement may be related to the fact that 61% of organizations use a versioned file-based system and email for collaboration.
- There is no software that has dominated the space to streamline the iterative nature between design and simulations. 12% have developed proprietary software to fill this simulation-led design and MODSIM niche.

Engineering.com would like to thank the participants of this study. By sharing their knowledge and allowing others to see how they compare, they have enriched the entire engineering community.

Thanks for reading,
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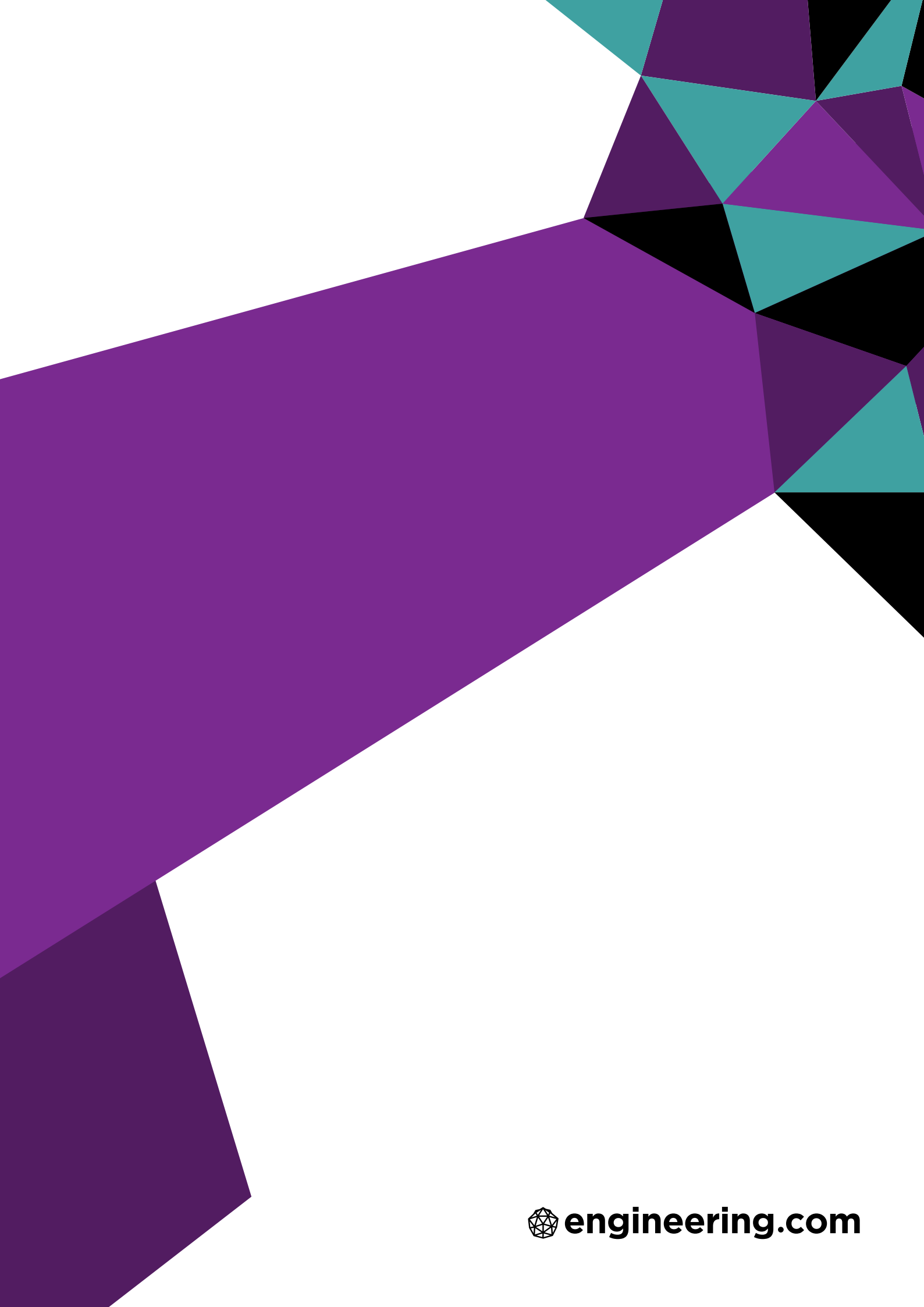

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