



Generative Design —

Engineering Meets AI Creativity

Insights Article with
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A New Era of Design

For centuries, design has followed a familiar path: an engineer sketches, tests, refine, and hopes to land on the best possible solution. But what if design didn't have to be limited by a single human imagination, or even a dozen? What if thousands of optimized solutions could be explored in the time it takes to finish a cup of coffee?

This is the promise of **Generative Design**, a groundbreaking approach where human creativity meets artificial intelligence. Instead of painstakingly crafting one design at a time, engineers set the rules of the game: goals, constraints, materials, and conditions. The software then becomes an untiring co-creator, generating thousands of possibilities, each one optimized for performance, cost, and manufacturability.

Generative design represents a profound **shift in mindset**. It turns traditional design thinking upside down, transforming engineering into a collaborative exploration between human intent and machine intelligence.

Why It Matters Designing a Smarter Future?

Generative design matters because it unlocks possibilities that reshape how we think about engineering. It enables **unprecedented innovation**, producing radical geometries and performance improvements that human designers might easily overlook.

It also delivers **speed and efficiency**. By allowing engineers to explore thousands of design alternatives in parallel, generative design drastically reduces development time and cost. What once required weeks of iterations can now be achieved in hours, accelerating projects and freeing teams to focus on higher-level decision-making.

Perhaps most importantly, generative design empowers **multi-objective optimization**. Designs can be simultaneously tailored for weight reduction, strength, cost, and manufacturability. The result is smarter, more resilient solutions that balance competing priorities without compromise.



Inside the Process – Lessons from Fusion 360

One of the most important lessons in working with generative design is that **the quality of outcomes depends entirely on the clarity of setup.**

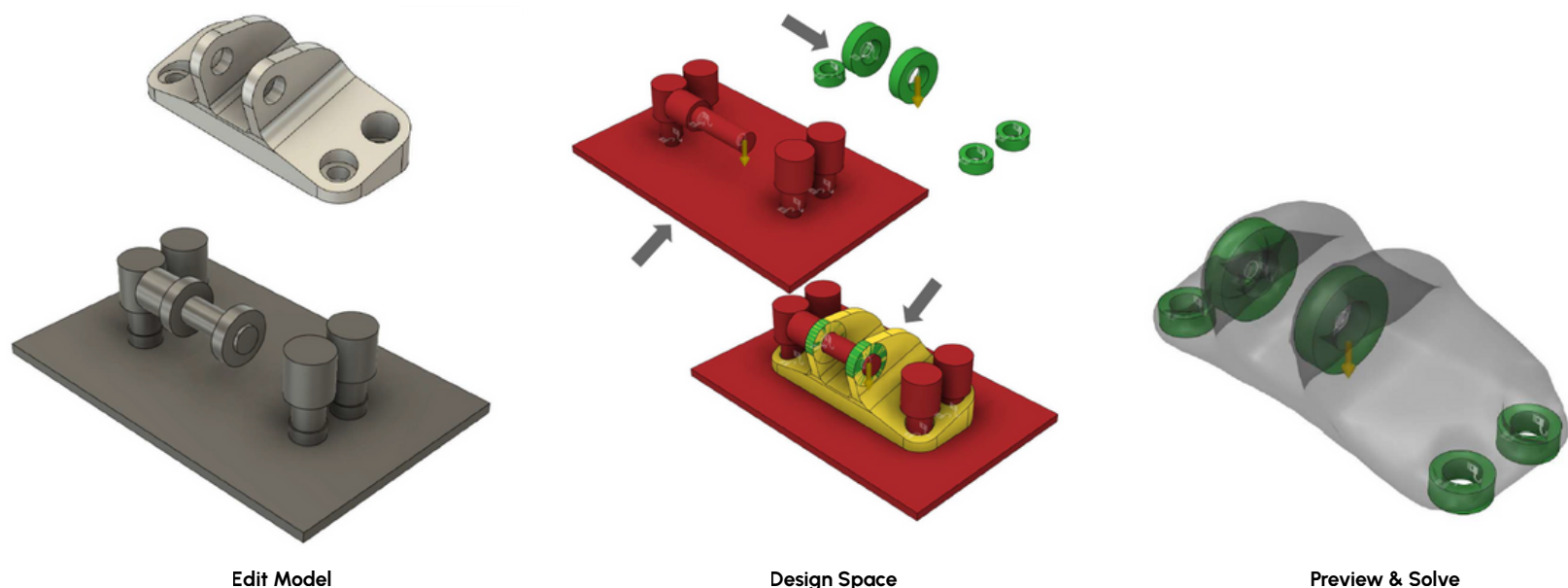
The process begins with establishing the **design space**:

- **Preserve geometries** regions that must remain intact.
- **Obstacle geometries** areas the software must avoid.
- **Starting Shapes** optional elements that guide connectivity when preserve regions do not align directly

Next come the **design conditions**, where loads and structural constraints are applied. These represent the real-world forces a part will experience, and the accuracy of this stage directly impacts the reliability of the generated designs.

Equally crucial are **material choices** and **manufacturing methods**. Whether additive manufacturing or traditional subtractive processes, each pathway shapes the geometry differently. Selecting multiple options allows the software to explore a wider solution space, testing outcomes against real-world feasibility.

Perhaps the most striking lesson is that **design is no longer linear**. Instead of moving step by step toward a single outcome, Fusion 360 transforms design into a dynamic exploration. Engineers collaborate with the software, refining inputs and exploring alternatives, until the “best-fit” solutions emerge.



Sustainability in Action – Smarter, Cleaner, Responsible

At the core is material efficiency. Generative algorithms often produce lightweight structures that use significantly less raw material, without compromising on strength or durability. This reduction directly supports responsible resource use.

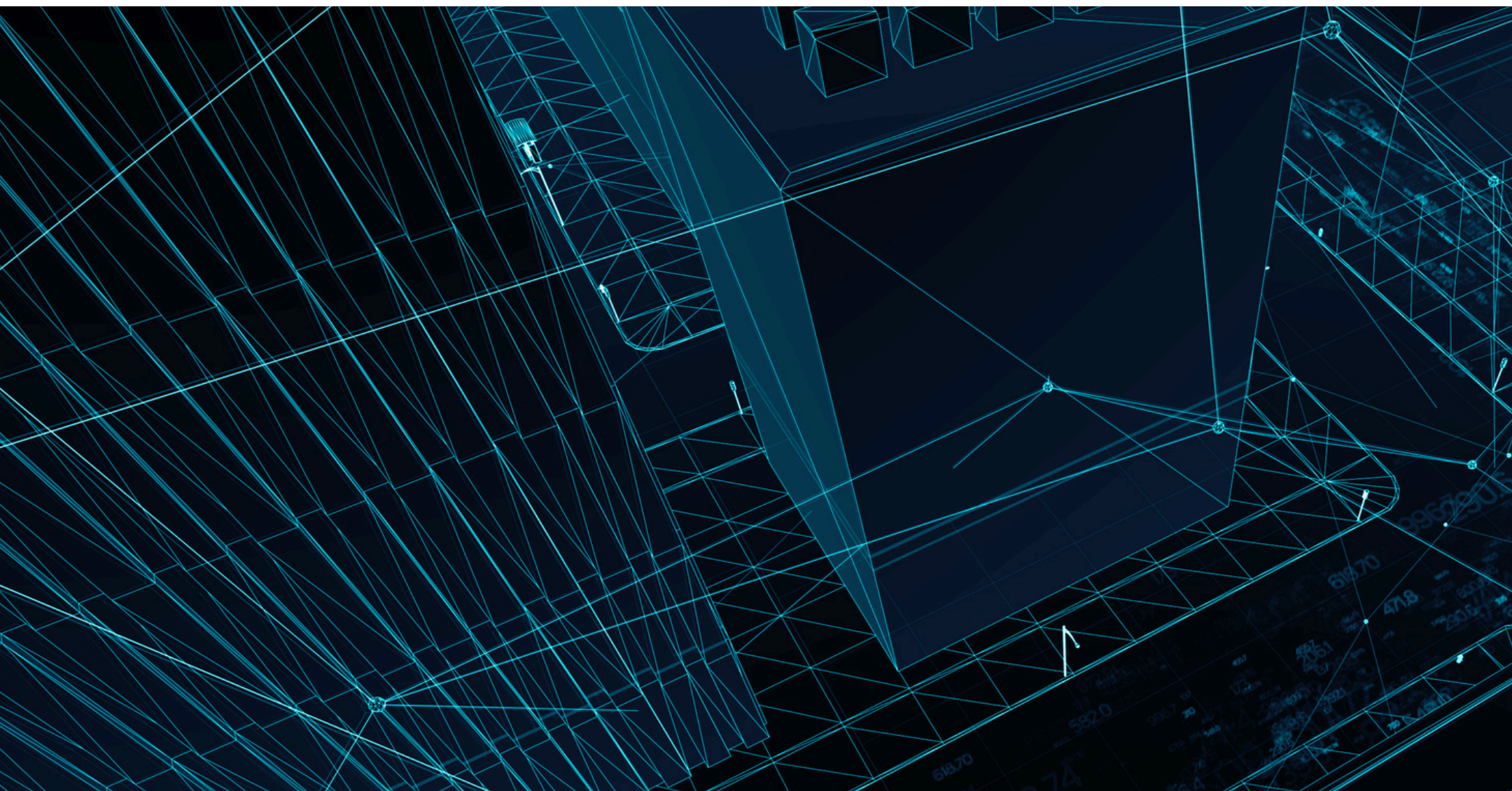
Lighter parts require less energy during transportation and operation, creating ripple effects across industries such as aviation, automotive, and construction, thus extending the benefits further into energy savings..

Another dimension is design for recyclability. Engineers can select materials and manufacturing processes that align with circular economic principles, ensuring components are easier to reclaim, reuse, or repurpose at the end of their lifecycle.

Finally, technology contributes to waste reduction. By optimizing parts for additive manufacturing, it minimizes excess material and tooling waste, enabling cleaner production practices compared to traditional subtractive methods.

Closing - A Future Designed Together

For Egis, this approach reflects a wider vision: smarter infrastructure, greener cities, and innovative solutions that endure. Therefore, we recognize that the future of design is no longer shaped by human imagination alone, but by the partnership between engineer and algorithm, unlocking pathways to lighter, stronger, and cleaner outcomes.





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a sustainable future

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Operating in 100 countries, Egis puts the expertise of its 22,000 employees at the service of our clients and develops cutting-edge innovations accessible to all projects. Through our wide range of activities, Egis is a key player in the collective organisation of society and the living environment of citizens all over the world.

Our operations in the Middle East are underpinned by key strategic acquisitions and a deep understanding of local market conditions. Egis' long and distinguished history, providing a comprehensive suite of engineering, consulting, and project management services makes us a trusted partner for the region's governments, investors, and developers alike.

With 3,700 employees, across 8 countries in the Middle East, Egis has successfully delivered over 700 complex development projects in the region, stimulating economic growth and enhancing quality of life. We are firmly committed to sustainable development, positioning us as one of the top five firms, according to the Engineering News Record (ENR) rankings.

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