AI-Driven Design Optimization of Offshore Wind Turbine Towers: Unlocking the Path to Upscaling

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IDEAS TO IMPACT

MIT Portugal
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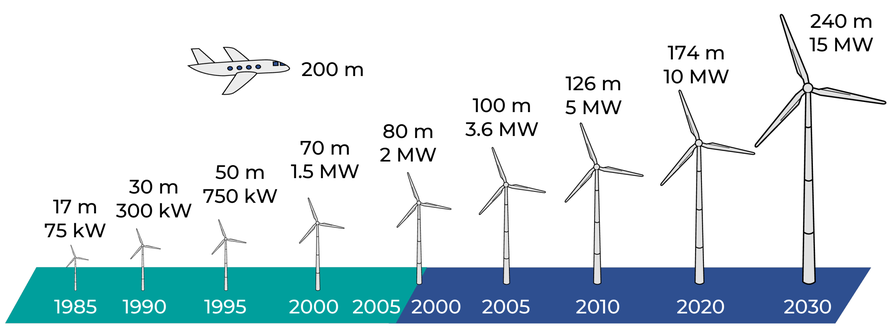
Evolution of Wind Energy

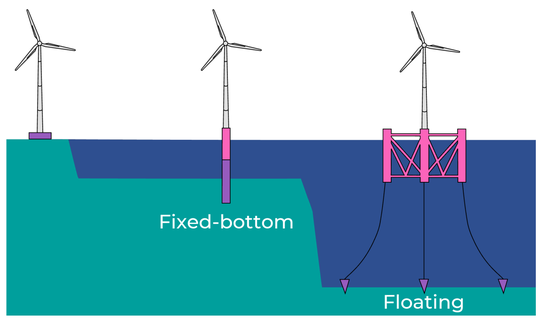
From Onshore to Offshore

Offshore wind turbines capture stronger, more consistent winds, enabling larger energy production with reduced visual and noise disturbances.



From Fixed-bottom to Floating

Offshore wind farms started with fixed foundations, then moved to floating for stronger winds and deeper waters.

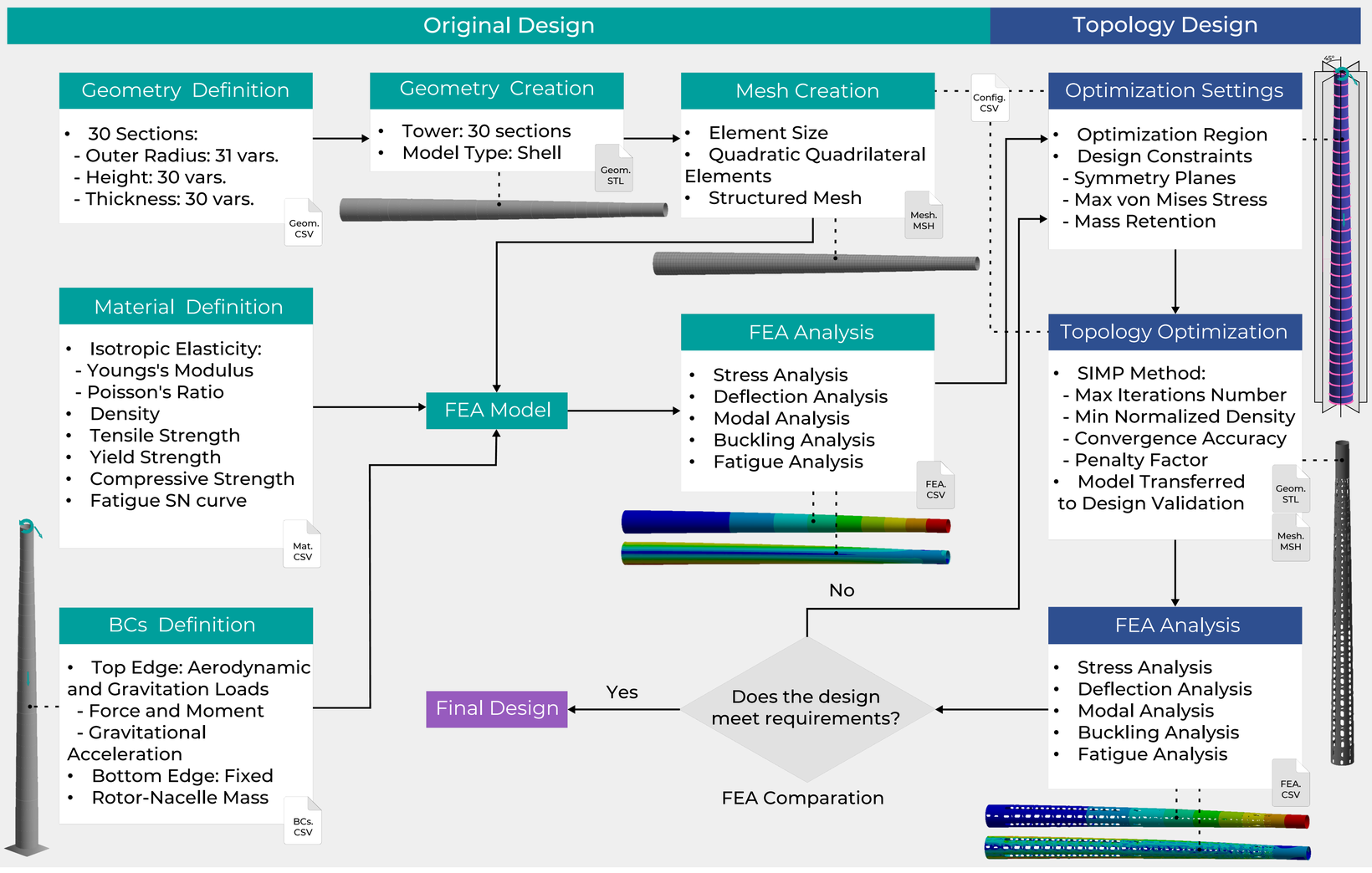


Tower: Crucial in Upscaling

As turbines increase in size, towers need to support larger blades and higher loads, while reducing mass and costs. The optimization of tower design is critical to improving efficiency without compromising structural integrity or economic viability.

Methodology

1. Dataset Generation

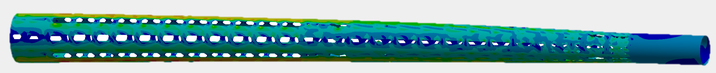


2. AI Model Development

3. Generative Design

4. Physical Predictions

Displacement Field



Von Mises Field

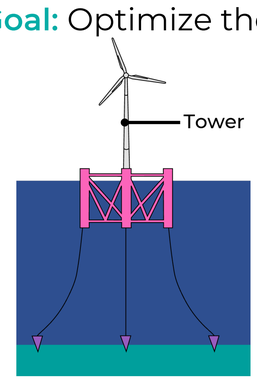
Legend

Input File

Output File

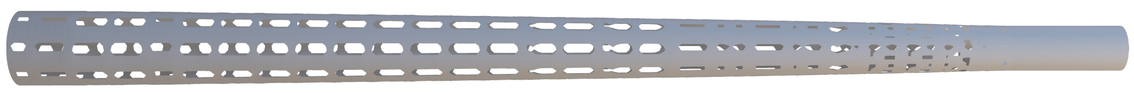
Application

Goal: Optimize the design of the tower for the 22 MW floating offshore wind turbine.

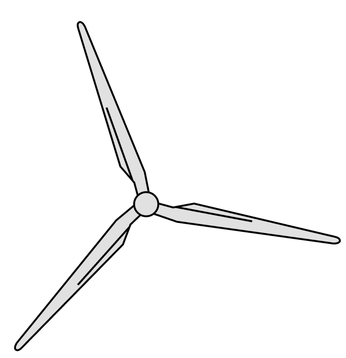


Current Solution

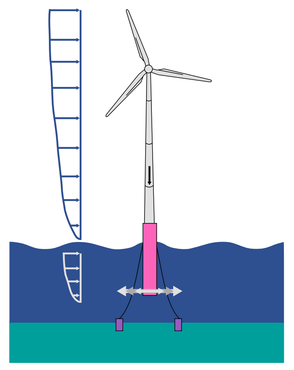
Our Method



Future Work



Apply to Blades



Multiphysics

Conclusion

Our AI-driven model optimizes tower design by integrating physics with AI, enabling the generation of new designs, faster simulations, and supporting efficient upscaling for more cost-effective wind energy systems.

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