MAY 2024

2024 EDGE WORKSHOP ON GENERATIVE DESIGN

Day 1 – Kickoff and Workshop Introduction

1) Motivation; 2) EDGE Project Intro; 3) Workshop Day 1 Agenda; 4) Workshop Logistics

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Welcome to The 2024 EDGE Workshop

Acknowledgement

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Motivation

- What is Generative Design?

  → **Design Space Exploration?**

- What is Generative Design Thinking?

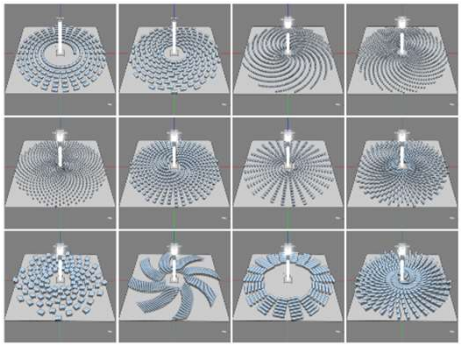
  → **What are the core competencies?**

  → **How is it different from traditional engineering design thinking?**

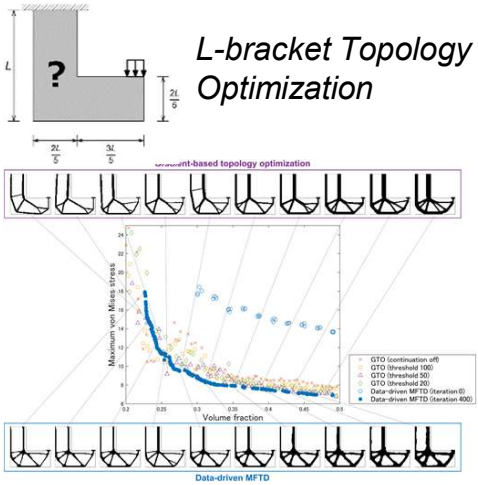
- What is the relationship between Generative AI (GenAI) and Design?

  → **How and Where?**

- What is the perspective from industry and practitioners?



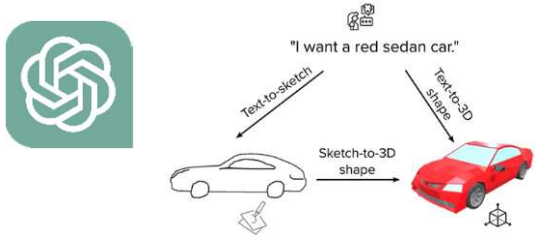
Heliostat field pattern exploration using Aladdin [C. Xie, IFI]



L-bracket Topology Optimization

[T. Kii, K. Yaji, K. Fujita, Z. Sha, C. C. Seepersad, JMD, 2024]

Sketch2CAD [X. Li, C. Xie, Z. Sha, JMD, 2022]



Cross-Modal Synthesis [X. Li, Y. Wang, Z. Sha. JMD. 2023]

Motivation

- How to educate next-generation engineers to be a generative designer or generative thinker?

- How to integrate generative design and generative AI into the existing curriculum in design education?
  - **Design Methodology**: Mindmapping, 6-3-5, morph matrix, TRIZ, Pugh chart, etc.
  - **GenAI:** Do we still need to teach these methods? If so, how can we balance and integrate?

We are not seeking (and it is impossible) to answer all these questions in one workshop.

Workshop Goals

1. **Share best practices** for teaching generative design and generative AI in engineering.

2. **Exchange ideas** on generative design curriculum development.

3. **Promote industrial-academia collaboration** for cutting-edge developments in generative design research and computer-aided design (CAD) education.

EDGE Project Background

National Science Foundation (NSF)
Accelerating Discovery: Educating the Future STEM Workforce (AD)

"A well-prepared, innovative science, technology, engineering, and mathematics (STEM) workforce is crucial to the Nation's prosperity and security. To accelerate progress in these areas, the next generation of STEM professionals will need to master new knowledge and skills, collaborate across disciplines, and shape the future of the human-technology interface in the workplace."

Project PI Team

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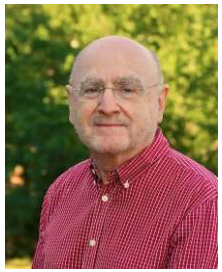

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Rachel Switzky
Director of Siebel Center
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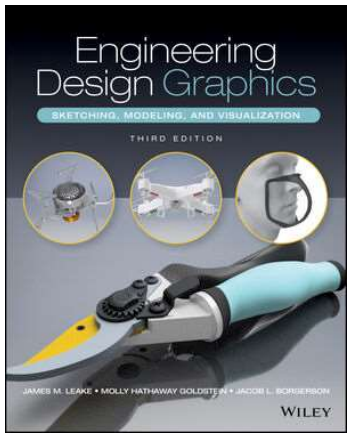
Research Goal

To define, implement, and disseminate **Generative Design Thinking** to facilitate the teaching and learning of generative design

Research Questions

- *RQ1.* **Theoretical perspective:** What are the essential elements of generative design thinking that students must acquire in order to work effectively at the human technology frontier in engineering?
- *RQ2.* **Practical perspective:** To what extent and in what ways can the project products support the learning of generative design as indicated by students' gains in generative design thinking?
- *RQ3.* **Affective perspective:** To what extent and in what ways can AI affect the professional formation of engineers as indicated by the changes of students' interest and self-efficacy in engineering?

Key Outcomes and Dissemination



Engineering Design Graphics: Sketching, Modeling, and Visualization, 3rd Edition

1. Aladdin – **Cloud-based, AI-powered GD software**
2. **GD curriculum and instructional** materials
3. **Data-driven generative design** approaches, e.g., Sketch-to-3D, Image2CADSeq, LLM4CAD, etc.
4. **CAD-based renewable energy systems challenge** for data collection
5. **Human-centered** generative design framework
6. **Evolving Design Thinking** model for **systematic review of engineering design thinking**

1 Book chapter, **6** Journal articles, **8** Refereed conference papers, **7** Conference abstracts and posters, **2** Doctoral dissertations, **2** Master's thesis

Workshop Agenda – Day 1

- ❑ 1:30 – 2:00 PM –Zhenghui Sha, UT Austin: **Workshop Kick-off and Introduction**
- ❑ 2:00 – 3:30 PM – **Industrial Session**:
  - 2:00 – 2:30 – Jordan Cox, PTC
  - 2:30 – 3:00 – Chris Gromek, Demonstration of PTC Generative Design Technology
  - 3:00 – 3:30 – Charles Xie, Institute for Future Intelligence
- ❑ 3:30 – 5:00 PM – **Hands-on Session**
  - 3:30 – 4:00 – Aladdin Hands-on Demonstration
  - 4:00 – 5:00 – Hands-on Design Challenge with Onshape Generative Design
- ❑ 6:00 PM – **Reception/Dinner** at Strega Italiano

Workshop Logistics

1. **Check-in Process**
   - Check-in every day with different passes
2. **Transportation**
   - Carpooling; shared mobility
   - Parking validation
3. **Meals**
   - Day 2, Day 3 lunch and dinner at your own preferences
   - Reimbursement as part of travel expense
4. **Travel reimbursement**
   - Upload your receipts
   - Our financial department will follow up. Could take up to 4-6 weeks
5. **Gift bag**
   - T-shirt size
   - …

Thank You!

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Opinions, findings, conclusions, or recommendations presented are only those of the presenter and do not reflect the views of the NSF