

# End-user Programming for CAD Systems via Language Design and Synthesis 2219864

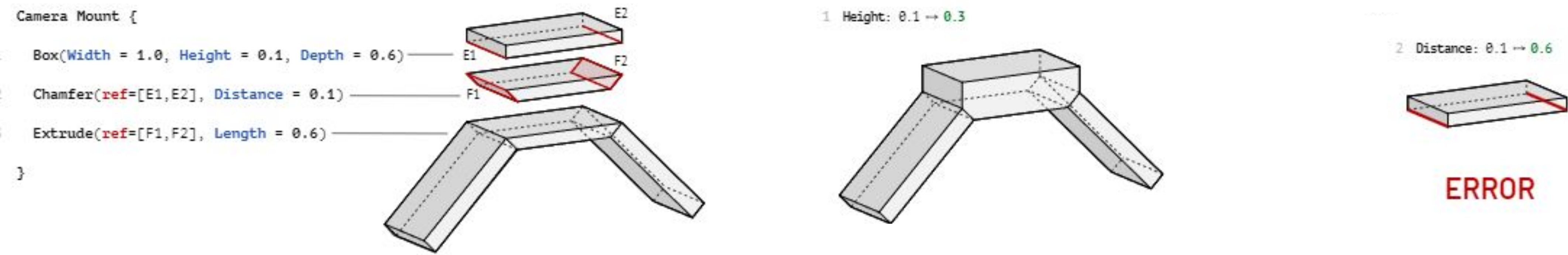
Ratislav Bodik<sup>1</sup>, Adriana Schulz\*<sup>1</sup> and Maneesh Agrawala<sup>2</sup>

\*Represented by Felix Hahnlein

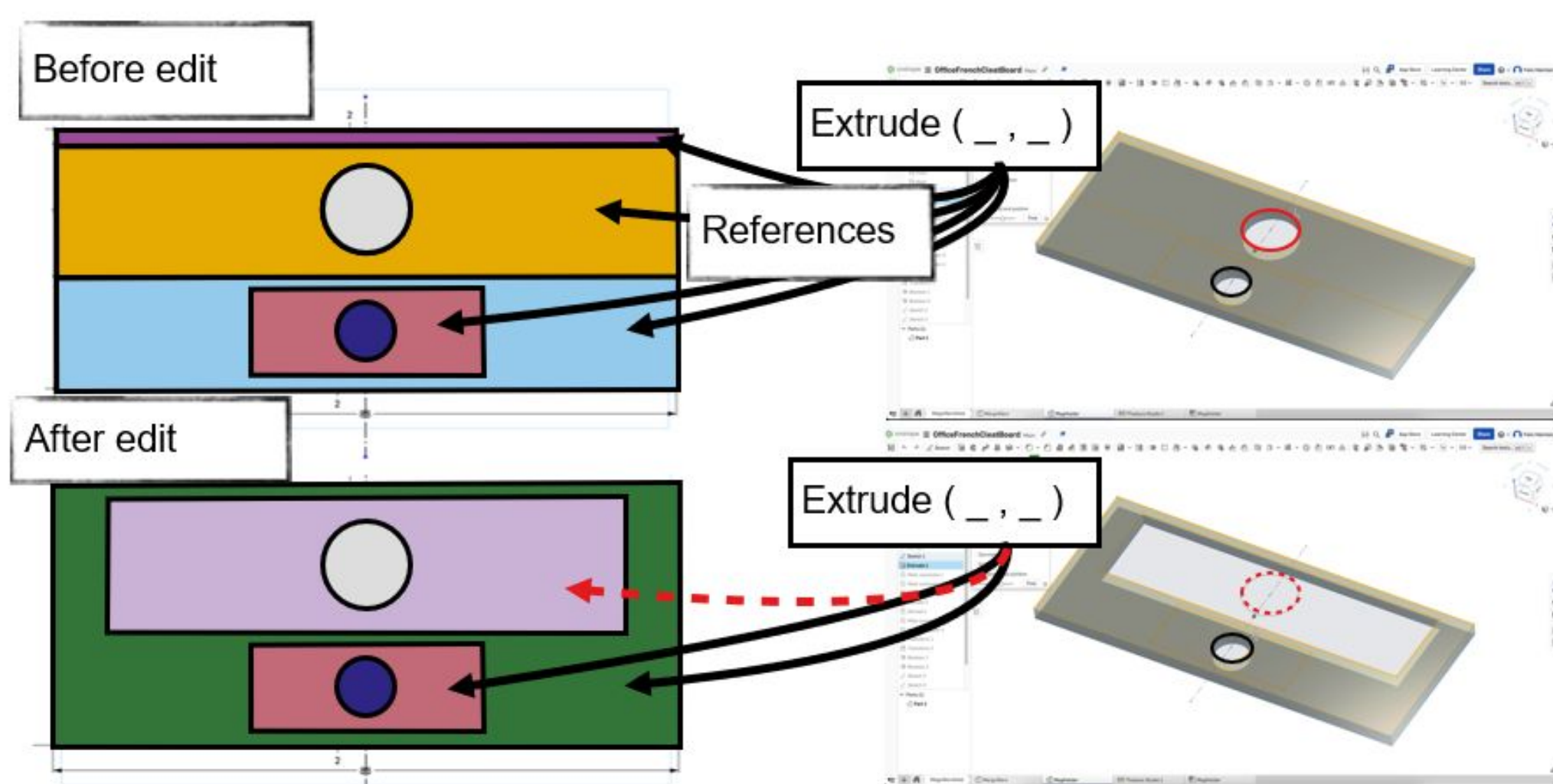
<sup>1</sup> University of Washington, <sup>2</sup> Stanford University



Almost all objects are modeled as CAD Programs, but CAD models are hard to reuse, or iterate on because CAD program manipulation often leads to failures.



The fundamental challenge is the need to keep track of **references to intermediate geometry** after edits.

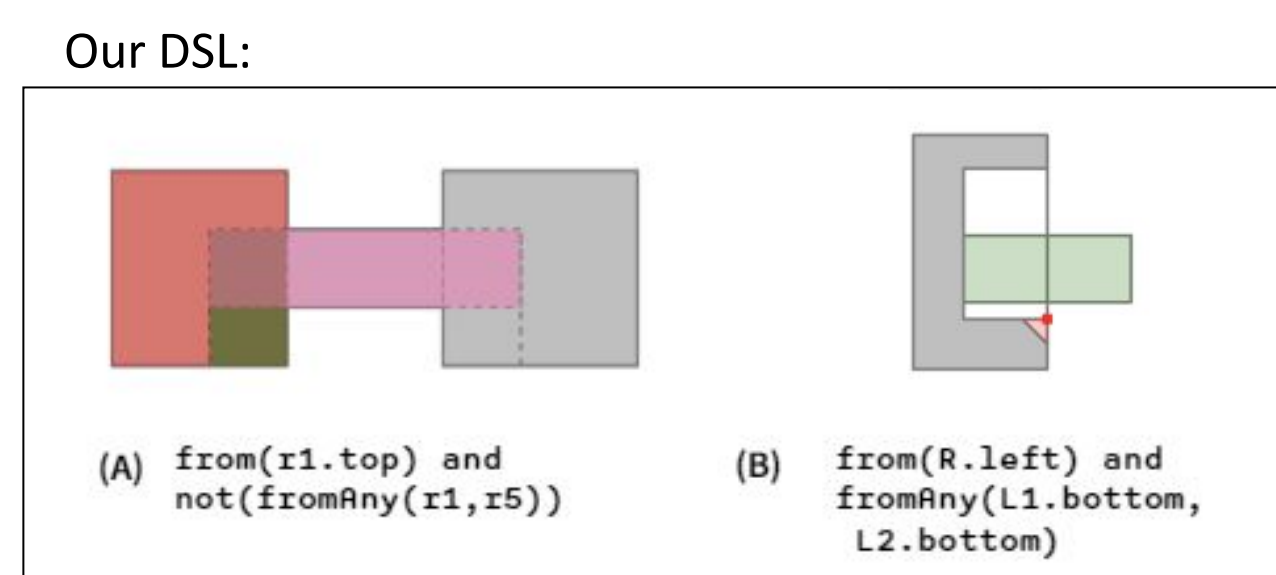
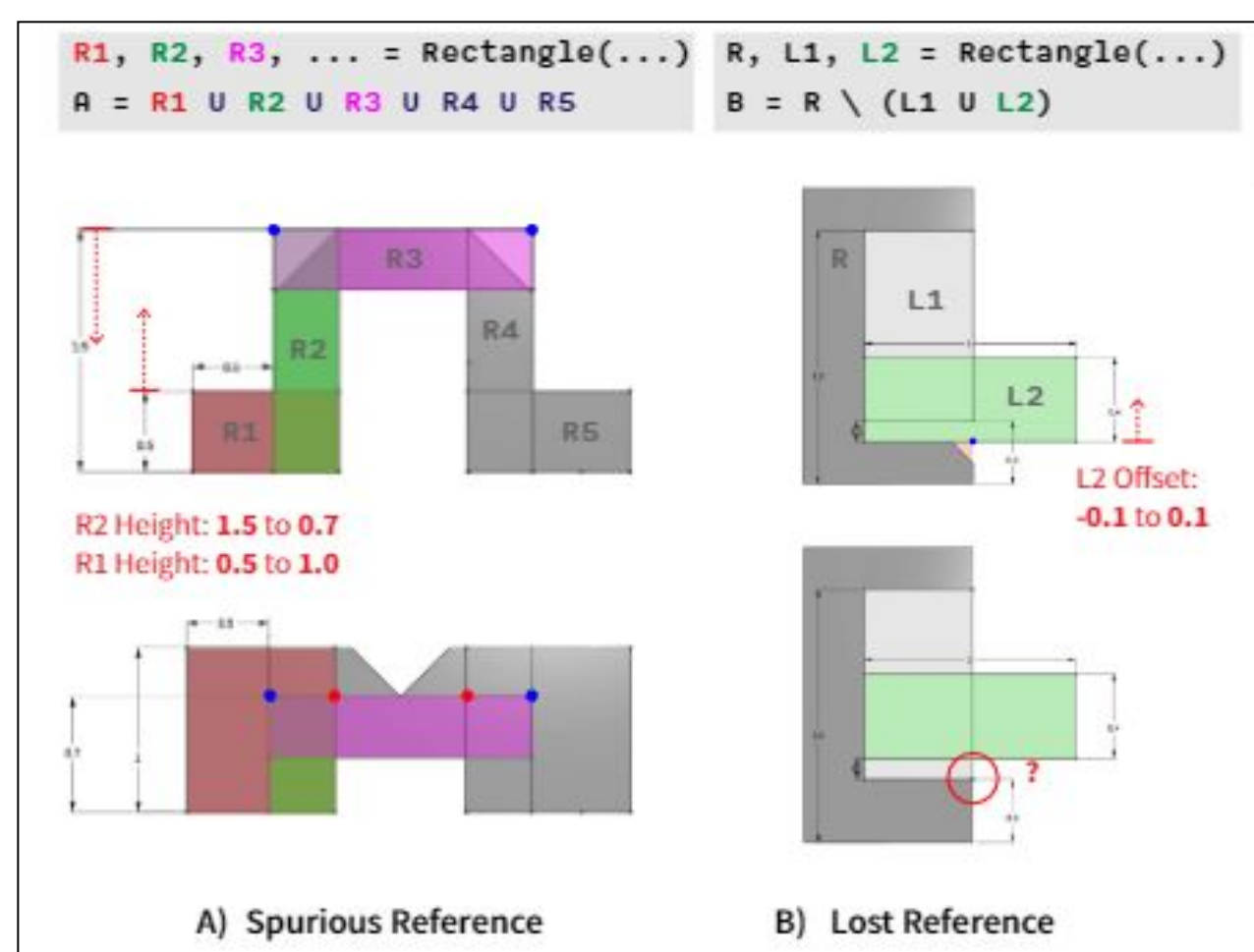


Our Research contributes:

- Novel reference semantics that can express programmer intent.
- Algorithms for automatic reasoning about programs that combine numerical computations with combinatorial computations.
- End-user programming for geometric domains, including interfaces for program interpretation and debugging.

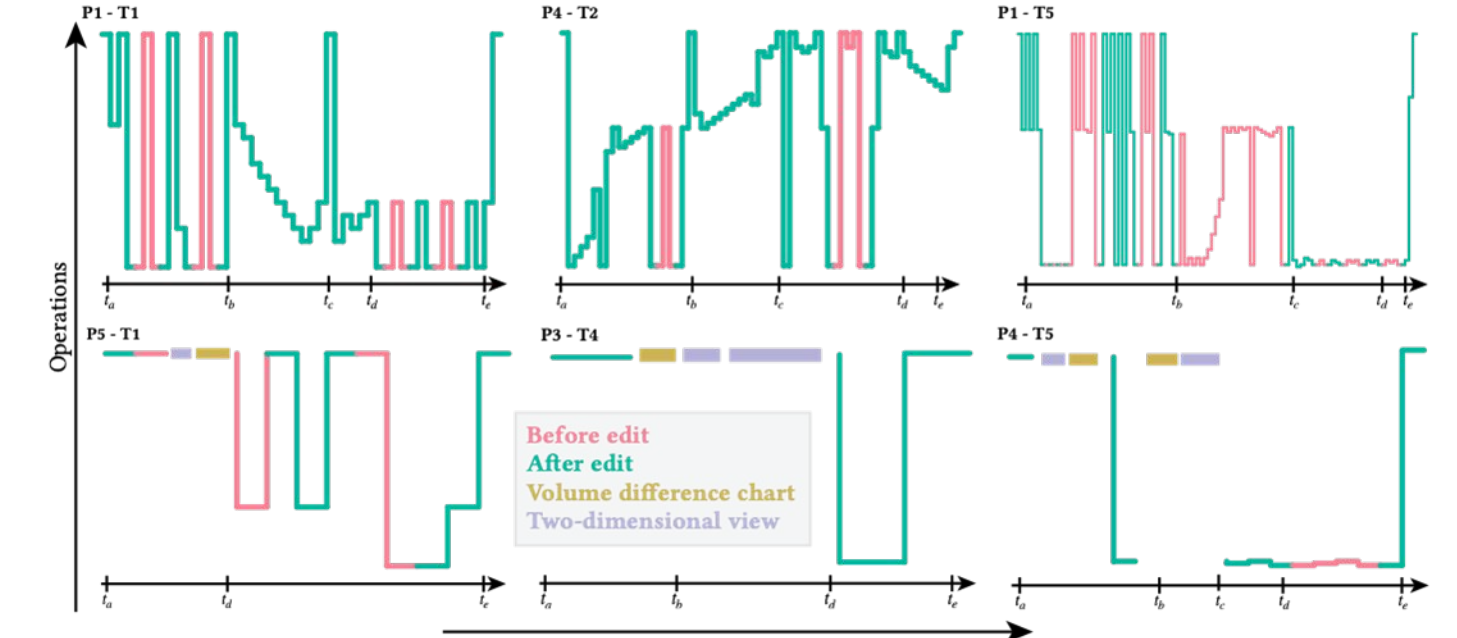
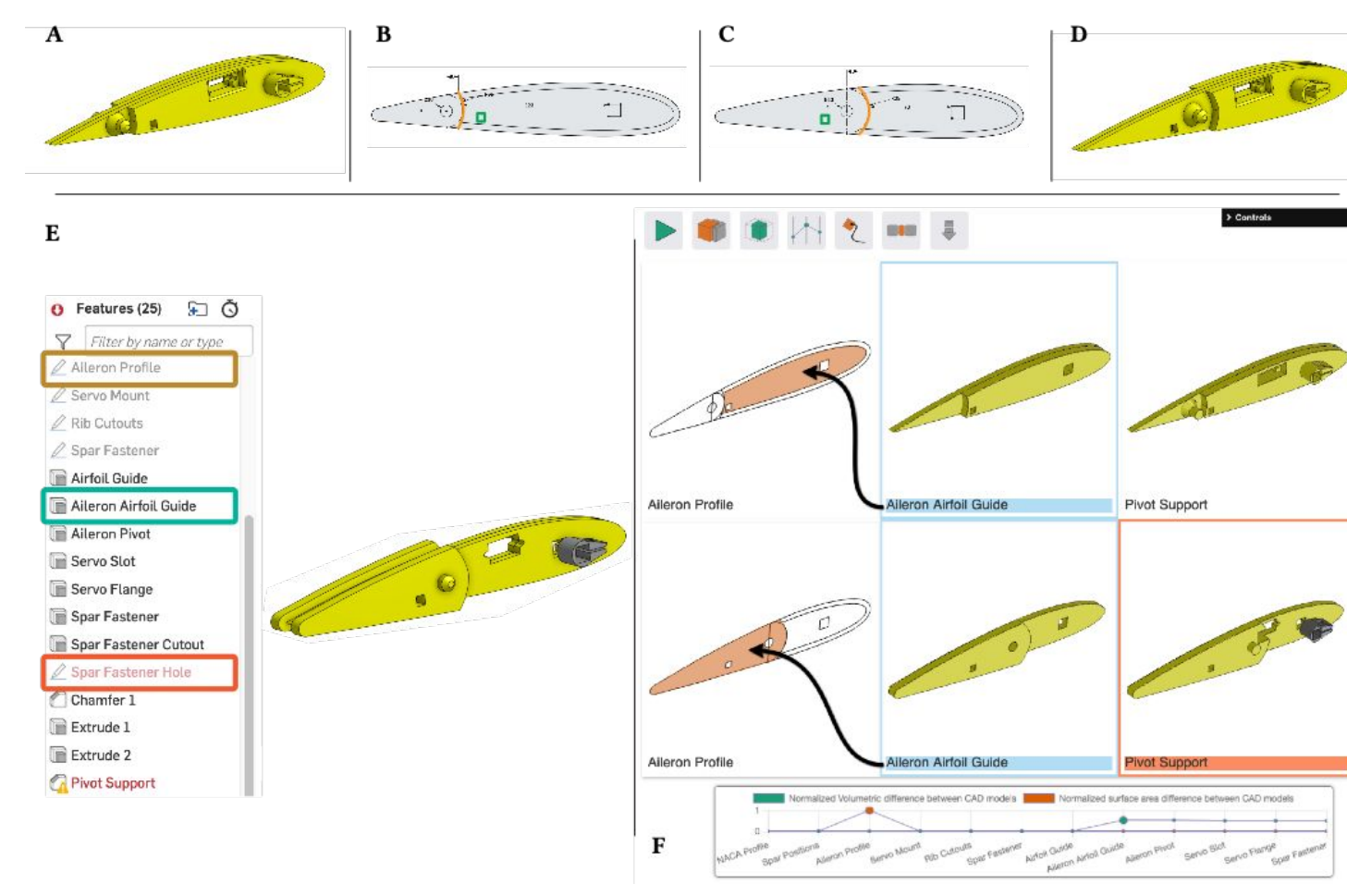
## Solutions:

Novel DSL with reliable semantic foundation based on lineage



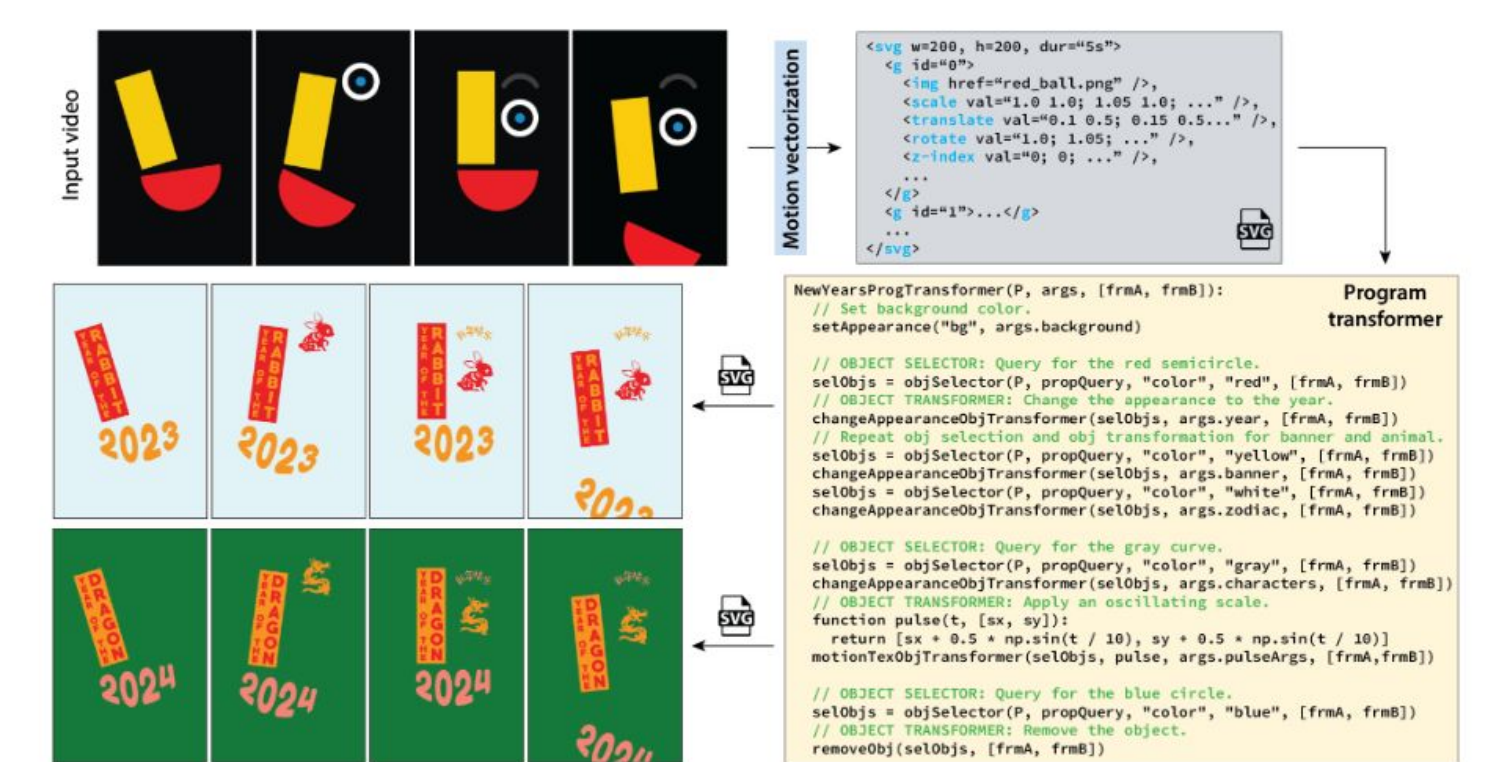
[PLDI 2023]

Interfaces for reasoning about CAD program and debugging errors

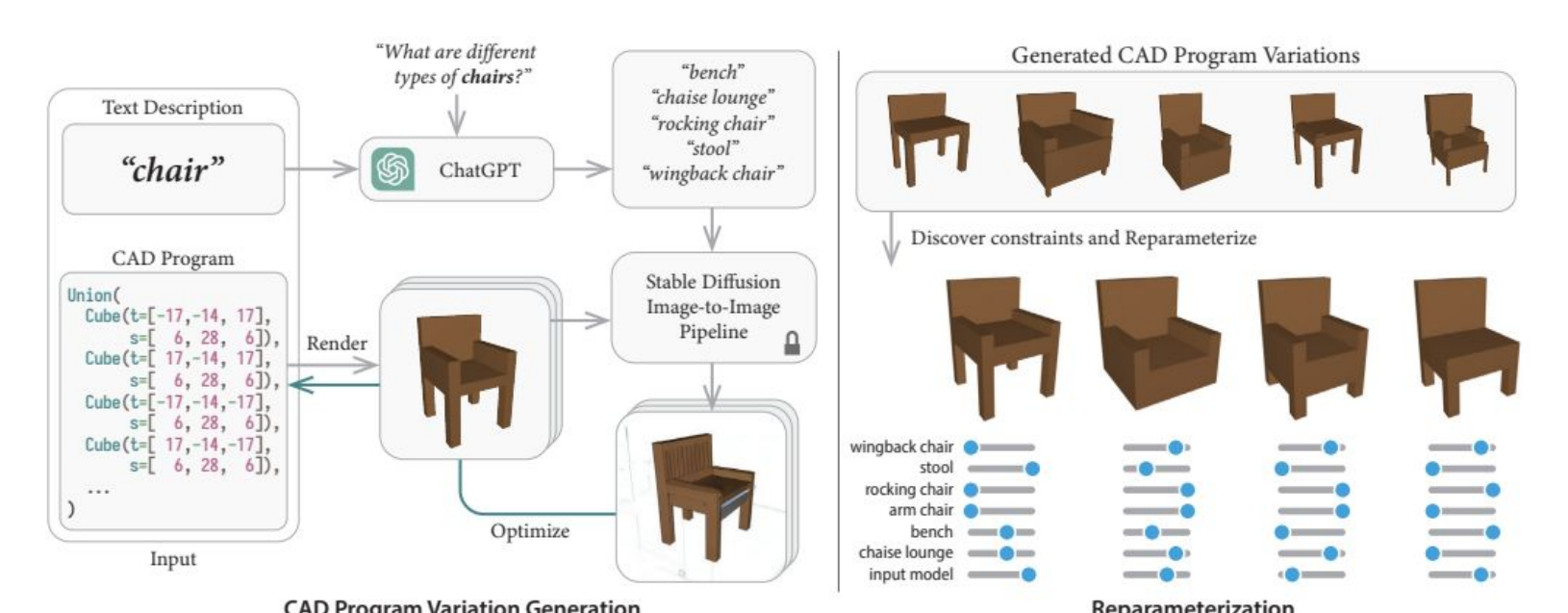


[UIST 2024]

Applications for interactive editing and shape discovery



[SIGGRAPH ASIA 2023]



[SIGGRAPH ASIA 2023]

Broader impact in Society:

- More efficient tools for professionals
- Reduce the barriers to entry for casual designers, promote a new age of DIY design.
- Example: Onshape (PCT) is currently looking into using our CAD debugging models

Broader Impact in Education

- Student Mentoring
- CAD as an introduction to programming to K12
- Material for graduate and Undergraduate courses in computational fabrication

Broadening Participation

- AI4ALL, Stanford
- Math Academy, UW
- WiGRAPH

