

Decompiling CAD using FP + Synthesis

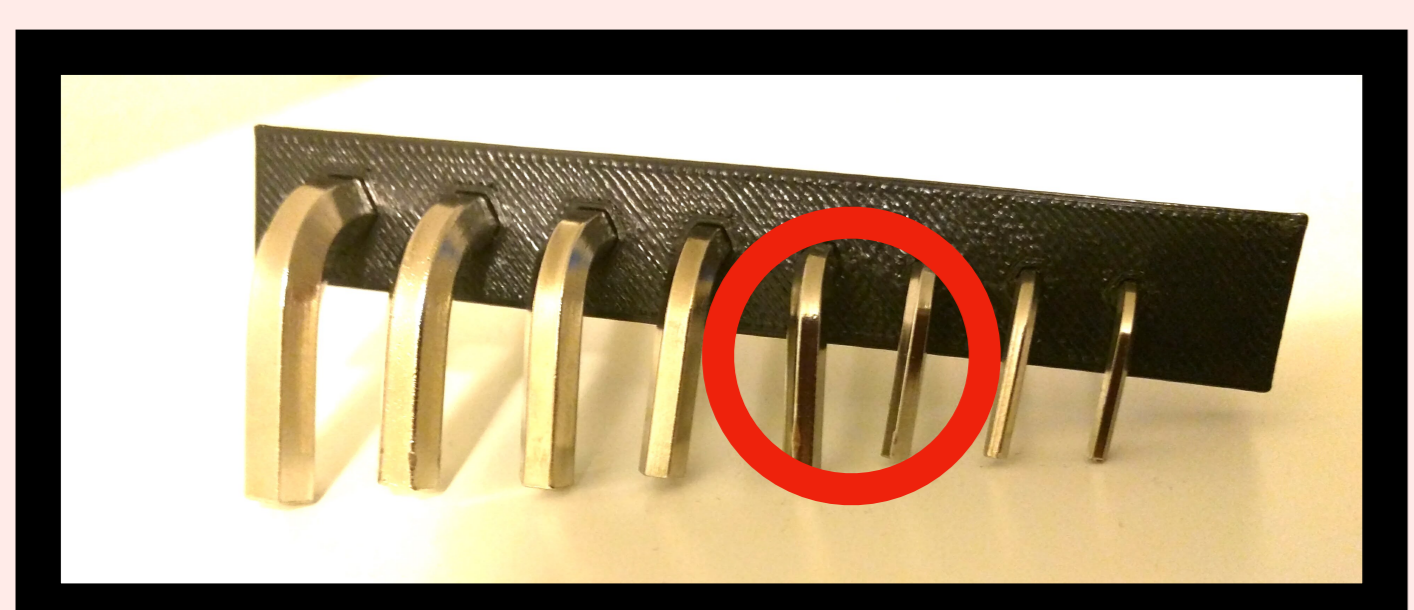
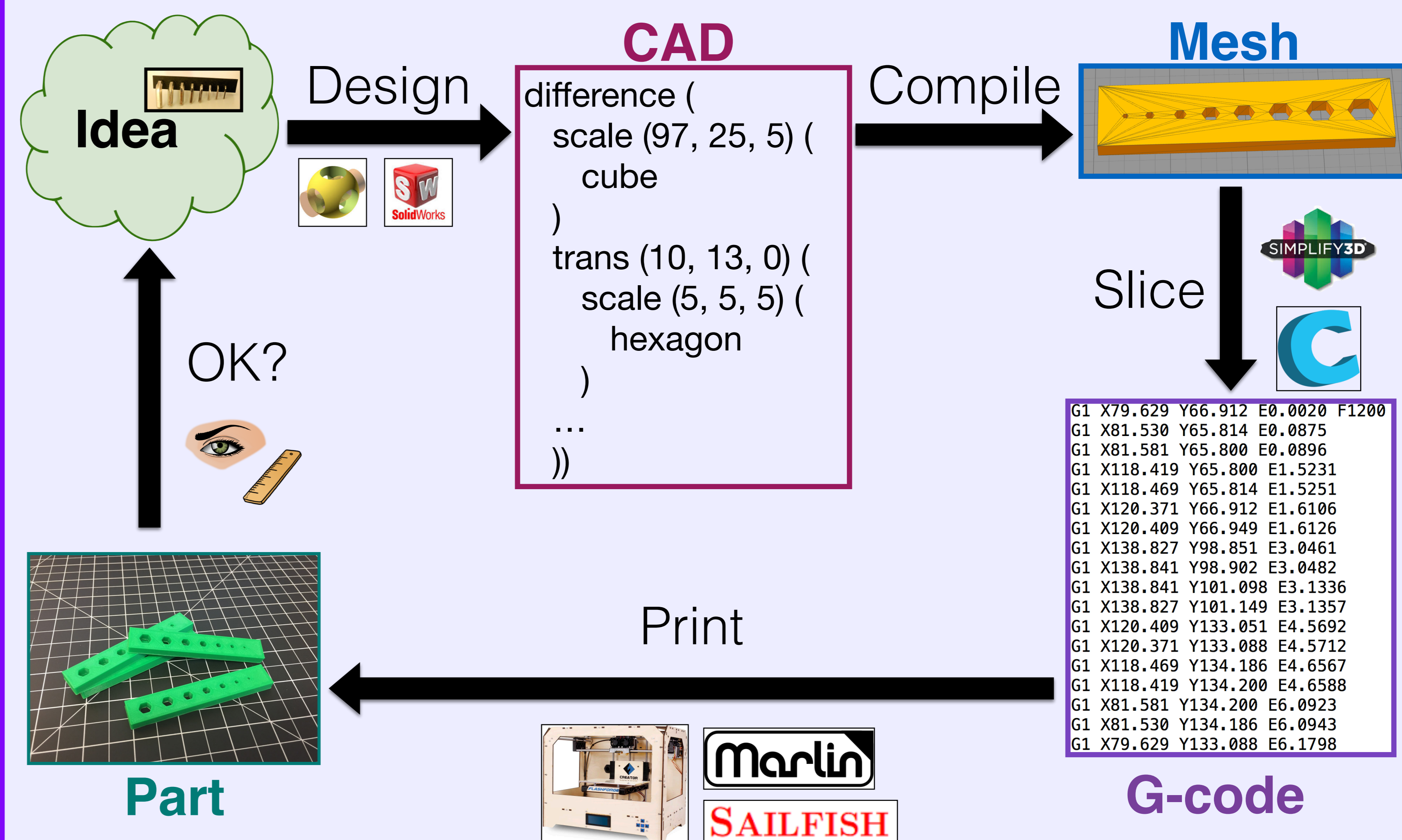
Chandrakana Nandi, James R. Wilcox, Pavel Panchekha, Adam Anderson, Taylor Blau, Dan Grossman, Zachary Tatlock

Designing CAD models is *hard*

Online design repositories like Thingiverse are popular alternatives

- + Shared as meshes
 - + CAD package agnostic
 - + Cheap
 - + Easy
- Immutable
 - Incomplete

3D Printing Pipeline = Compiler



synth

1600 LOC

```

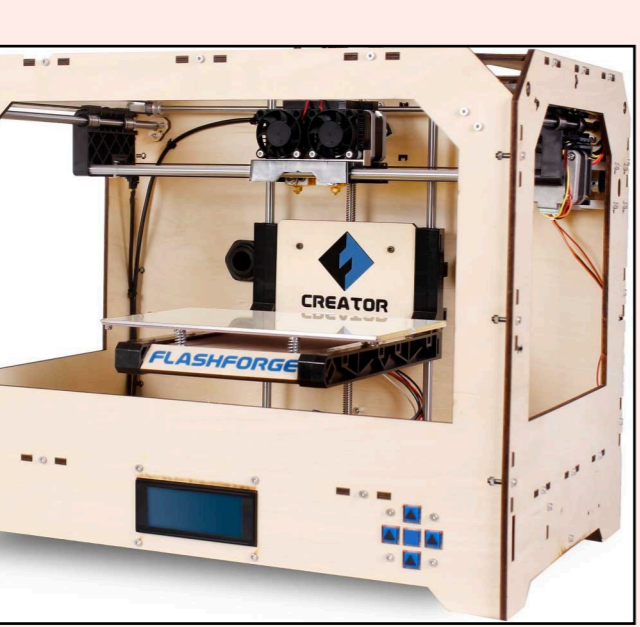
difference (
  scale (97.0, 25.0, 5.0) cube
  trans (49.0, 13.0, 2.5) (
    scale (7.0, 6.06, 5.0) (
      cylinder 6 ))
  ...)
    
```

80 LOC

edit

```

difference (
  scale (97.0, 25.0, 5.0) cube
  trans (49.0, 13.0, 2.5) (
    scale (7.0, 6.06, 5.0) (
      rotateZ (35.0) (
        cylinder 6 )))
  ...)
    
```



print

success!

PL Fab Foundations

Synthesis = search + oracles

- subtractive
- additive
- primitive matching

Need PL foundations:

- DSLs for CAD and Mesh
- denotational semantics
- evaluation contexts
- compiler correctness proof

Implementation in ~ 25,000 LOC of OCaml

github.com/uwplse/reincarnate-aec

Thingiverse models synthesized

