Dune 3D

The making of a maker's tool

Lukas

FOSDEM 2024
what I do
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What do we need to make a 3D CAD?

3D viewport
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✓ 3D viewport
What do we need to make a 3D CAD?

✔ 3D viewport

Geometry kernel
What do we need to make a 3D CAD?

- 3D viewport
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What do we need to make a 3D CAD?

✓ 3D viewport
✓ Geometry kernel
✓ Solver
What do we need to make a 3D CAD?

- 3D viewport
- Geometry kernel
- Solver

TECHNOLOGY: SOLVING CONSTRAINTS

The core of any parametric CAD program is its geometric constraint solver. The solver starts with geometric properties of the sketch, like a line length or an angle or a tangency. Based on these properties, it calculates a simple representation of the sketch’s lines, points, and curves.

For a trivial example, we might specify that a point lies 10 mm from the origin, and 5 mm from the x-axis. We also specify that the line from the origin to that point makes a 65° angle with the z-axis. That point turns out to have \((x, y, z) = (8.66, 2.67, 4.23)\), after solving three equations in three unknowns. A real sketch may involve hundreds of unknowns.

In SolveSpace, constraints are represented as equations in a symbolic algebra system. In general, these equations are solved numerically, by a modified Newton’s method. Some special cases are handled, for any equation that

The constraint solver used in SolveSpace is available separately as a library.
What do we need to make a 3D CAD?

- ✔ 3D viewport
- ✔ Geometry kernel
- ✔ Solver

SOLVESPACE -- parametric 2d/3d CAD

TECHNOLOGY: SOLVING CONSTRAINTS

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![Image of 3D sketch with constraints and angles]
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- 3D viewport
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- User interface
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Dune 3D
parametric 3D CAD

6 Months
C++20

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33k LOC

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Dune 3D  
parametric 3D CAD  

6 Months  

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Dune 3D
parametric 3D CAD

C++20
33k LOC

gtkmm 4

JSON

6 Months

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This is the first versioned release of Dune 3D

See the docs for installation instructions.

Changelog

since this is the first versioned release, there is no changelog yet

Assets

- dune3d-1.0.0-x64.msi
- Source code (zip)
- Source code (tar.gz)
• Sketch
• Lines
• Arcs
• Circles
• Constraints
• All-in-one tool
• Regular polygon
• Rectangle
- Extrude
- Lathe
- Linear array
- Polar array
- 3D Constraints
- Distance
- Angle
- Point in plane
- Point/plane distance
- STEP import
- Extract reference points from model
- Chamfers
- Fillets
- Topological naming problem 😞
So how does it work?
So how does it work?
What's next?

- Measurements
- Revolution
- Copy/paste
- Better solver integration
- Various UI enhancements
That's it

dune3d.org