Gaudi Design Tools

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Overview

- The Design Process
- Target Audience
- Our Demands
- Rule Sets
- System Diagram
- Other

The Design Process

1. Programming
   - relationship to site
2. Conceptual Design
   - relationship between program elements, general shape
3. Schematic Design
   - plans & sections, materials
4. Design Development
   - line up contractors (plumbing & electrical, etc)
5. Construction Documents
   - papers for contractors
6. Construction Management

structural engineer consultation

The Design Process

1. Programming
   - relationship to site

target

2. Conceptual Design
   - relationship between program elements, general shape
3. Schematic Design
   - plans & sections, materials

← school stops here

4. Design Development
   - line up contractors (plumbing & electrical, etc)
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   - papers for contractors
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Target Audience

- Architects:
  - Virtual Structural Engineer
  - Faster (real-time) feedback
  - Enters into design process earlier
  - Can selectively ignore its suggestions
  - maintain control over design process
  - 70% of architects would be willing to try it (learning experience/teaching tool)
  - 10% of architects would actually use it seriously for design
- Structural Engineers?

Overview

- The Design Process
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  - Meshing
  - Simulation
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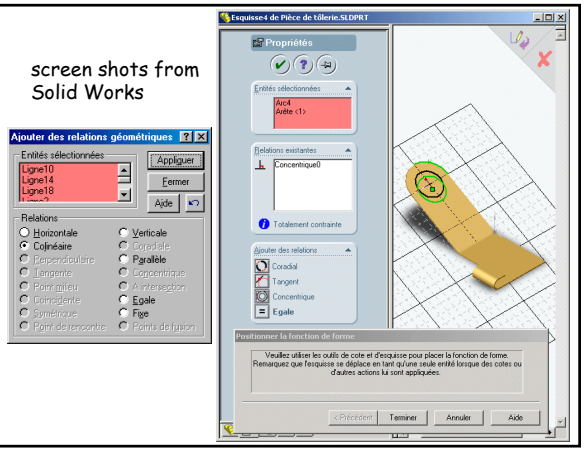
Meshing Controls

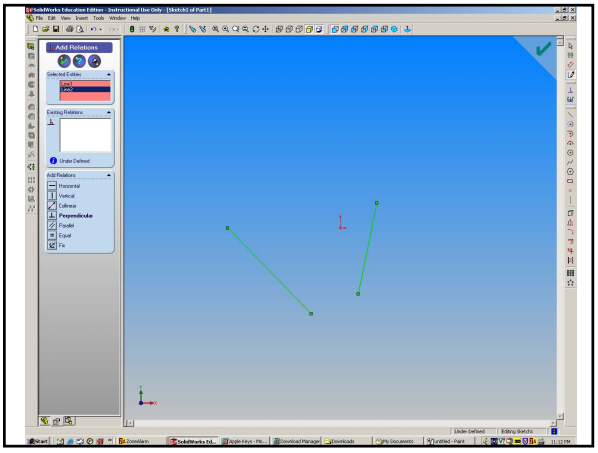
- string & node connectivity
- string length (set/equalize length)
- weights (set/equalize weights)
- platforms (set area/shape/dimensions)

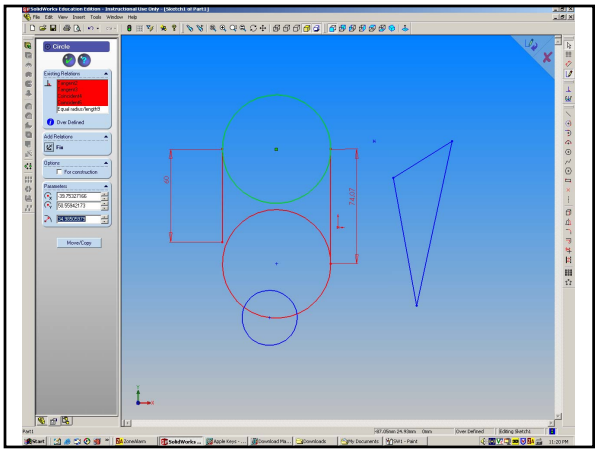
Simulation Controls

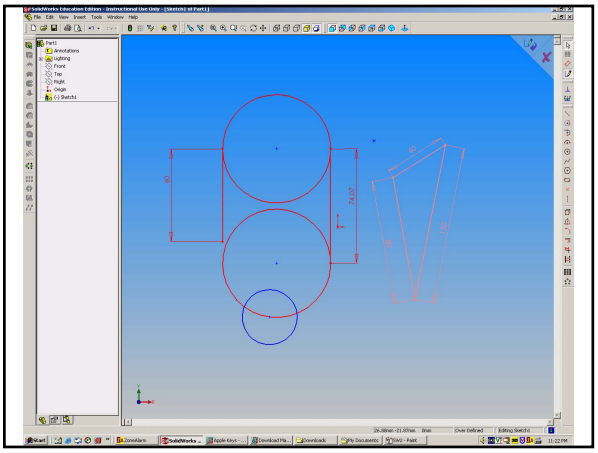
- angle between 2 strings
  (also, 2 strings are parallel)
- angle of string/platform relative to ground
- vertical height of node/platform
- (length of string, area of platform)

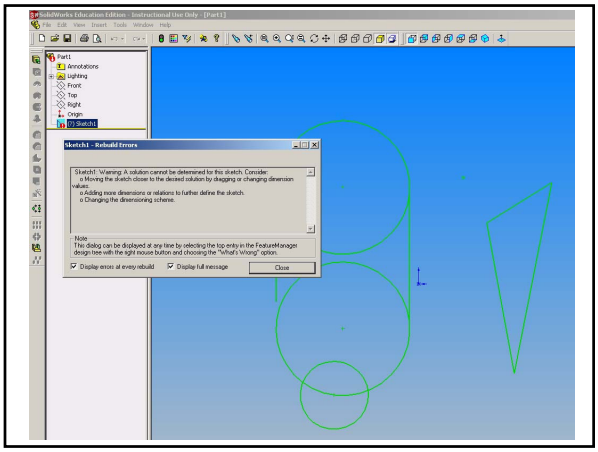
screen shots from Solid Works

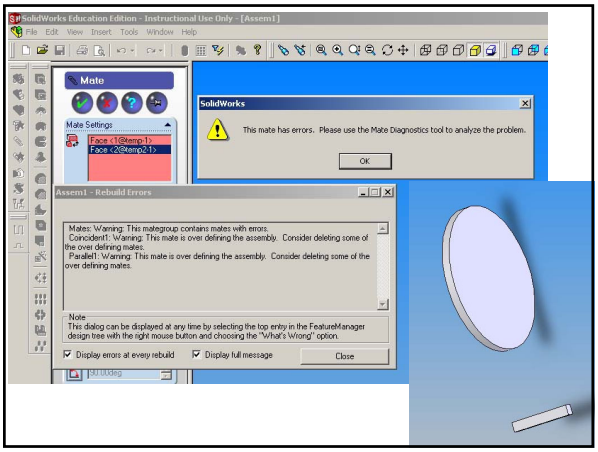












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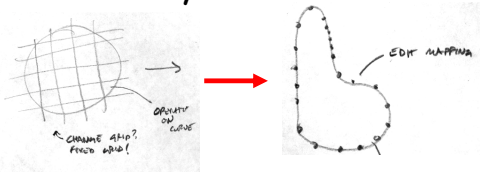
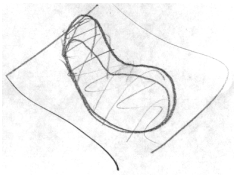
Rule Sets

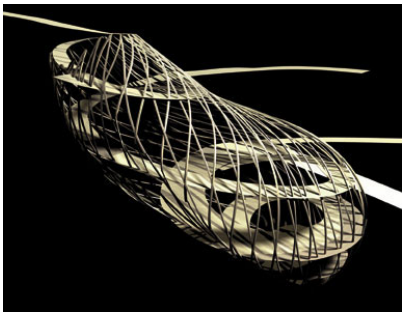
- Often architects develop a set of rules that will govern a particular design
  - Talia Dorsey
  - Talia Variant 1
  - Talia Variant 2
  - Floating Plan
  - Convex Hull Plan
  - Shape Driven
  - Structural Element Design
  - Tutorial/Design your own rule set

Talia Dorsey: fixed mesh



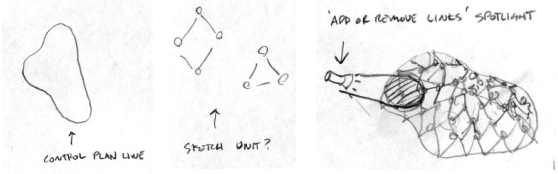
- editing 2 curves & the mapping between the curves
- fixed grid/mesh

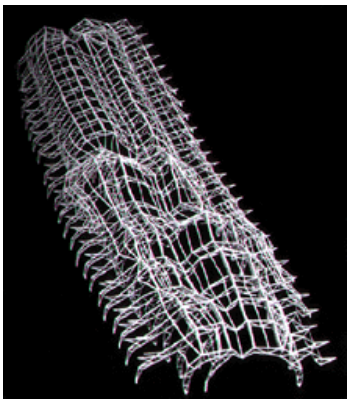




Talia: Variant 1

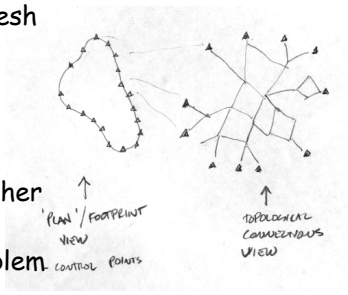
- Edit mesh (lengths & connectivity)
- shell/ 2D problem
- flashlight or magnet to increase/decrease the density of points

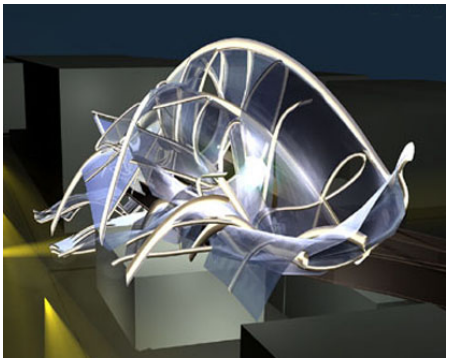




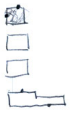
Talia: Variant 2

- non-regular mesh
- weird string topology
- weird surface topology
- editing 2D rather than strings
- shell/ 2D problem

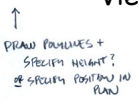


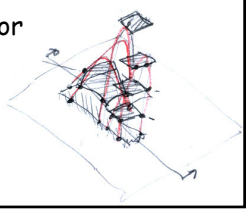


The Floating Plan



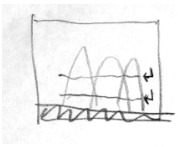
- Specify program spaces (area/height/shape)
- User provides initial strings
- System solves for placement in 3D
- View in section



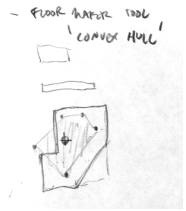


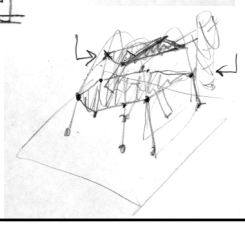
Convex Hull Plan

- Given Strings
- Specify height of each floor



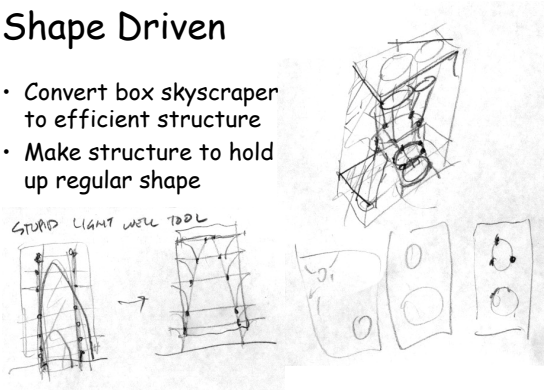
- Convex hull of string intersections defines initial plan
- Can edit plan

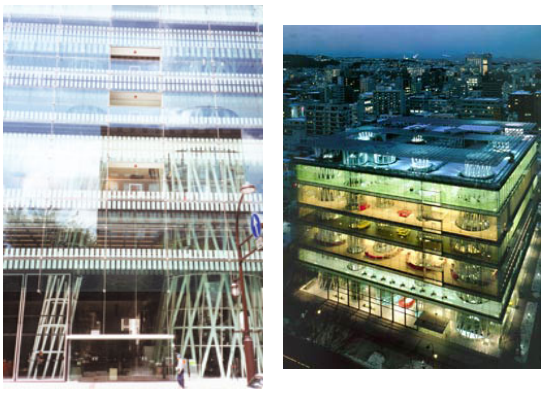




Shape Driven

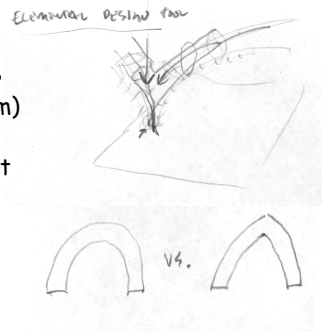
- Convert box skyscraper to efficient structure
- Make structure to hold up regular shape





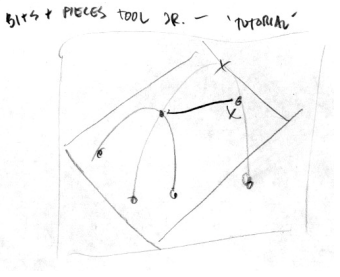
Structural Element Design

- Given local force diagram for a structural member (arch, column, beam)
- Visualize force paths for different loading conditions
- Edit volume
- "margin of safety"



Tutorial / String JR.

- Intuition builder
- Teaching tool
- Access to all simulation controls
- Build your own rule sets



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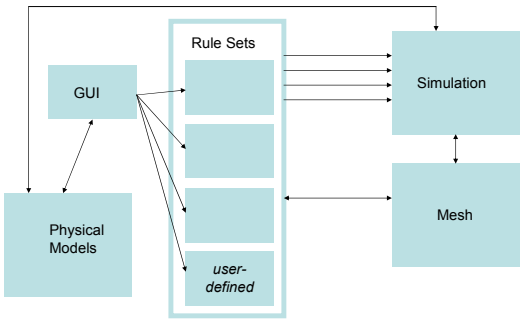
  - Visualization
  - GUI Issues
  - Defining Spaces with Strings
  - String/Platform Intersections

System Diagram: Tools



Visualization

- tension/compression
- magnitude of force
- "this string is redundant/useless"
  - no force is acting along its length
- "this set of constraints is impossible to satisfy" & *why*

GUI issues

- As much as possible, let's aim for a 2D control interface
- Let's match existing/common mouse/control-key navigation & editing

Defining Space with Strings?

- Architectural spaces are not necessarily defined by the arrangement of strings/load-bearing elements
- A string/column may cut through a space, but not be a "problem"

String/Platform Intersections

- Ignore
  - no connection & no weight transfer
- Create new node & fix the current string lengths
  - just a modeling/user interface problem
- Slide & Support
  - the string can slide (don't move the platform) but weight IS transferred
  - (probably the hardest to implement)