Wikilab, architecture & CNC
Collaborative architecture and construction with FreeCAD

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FOSDEM 2018
These slides available from FOSDEM website
The WikiLab

São Paulo, Brazil
Built in 2017

Based on WikiHouse
Built by volunteers
Fully open-source
The WikiHouse project

Do-it-yourself construction system made of CNC-cut wooden pieces

- Started in the UK in 2011
- Already several built units around the world
- Open-source
- Well-tested and matured system already
- http://wikihouse.cc
Wren Hardware

Wren components are CNC manufactured using structural-grade timber panel materials (typically, plywood) and can be rapidly assembled to produce a structural chassis, onto which other components such as cladding, windows, doors can be fitted.

Wren is in development. For full documentation on how Wren works and how you can contribute to its development, visit the Wren wiki

Wren Parametrics

This version of the Wren structural language has been developed in Grasshopper, the parametric scripting plugin for Rhino 3D. This computational design platform is widely used in the design and construction industries, and is ideally suited to digital manufacturing.

Other formats of the Wren system are currently being developed, but currently this version in Grasshopper format represents the latest thinking and workflow for the structural technology.

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FreeCAD

Open-source parametric 3D modeller

- Started in Germany in 2002
- Today probably the most well-known “technical” open-source 3D app
- Generic, many uses and specialties
- Parametric, objects are defined by their parameters
- http://freecadweb.org
Sketchup → FreeCAD

• Mesh geometry → Brep geometry (NURBS-based)
• Step-by-step conversion to parametric model
• Integration with other elements (brickwork, piping, etc...)
• Precise quantities
• Production of all needed files (2D plans, spreadsheets, mesh models for rendering, CNC code, etc)
Producing:

- 2D plans
- Mesh models for rendering
- Spreadsheets for quantities / pricing
- CNC code

...And FreeCAD code!
# Orçamento definitivo

**Lablivre Wikilab**

**data:** 31.01.2018  
**fonte PMSP:** [http://www.prefeitura.sp.gov.br/cidade/secretarias/obras/tabelas_de_custo](http://www.prefeitura.sp.gov.br/cidade/secretarias/obras/tabelas_de_custo)

<table>
<thead>
<tr>
<th>Escopo</th>
<th>Seção</th>
<th>Item</th>
<th>Descição</th>
<th>Quantidade</th>
<th>Unidade</th>
<th>Preço material</th>
<th>Preço mão de obra</th>
<th>Total material</th>
<th>Total mão de obra</th>
<th>Preço total</th>
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</thead>
<tbody>
<tr>
<td>1 Fundação, alvenaria e estrutura</td>
<td></td>
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<td>1.1</td>
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<td>Limpeza do terreno + remoção da camada vegetal em toda a área da construção (11m x 4.20m)</td>
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<td>46.37</td>
<td>m²</td>
<td>R$ 0.00</td>
<td>R$ 4.15</td>
<td>R$ 0.00</td>
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<td>Escavação manual das valas de 30cm x 30cm</td>
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<td>m³</td>
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<td>1.4</td>
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<td>Lastro de concreto de 5cm no terreno todo</td>
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<td>m³</td>
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<td>Sapata corrida em alvenaria de bloco de concreto estrutural de 19cm (duas fileiras, fileira de cima em bloco canaleta)</td>
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<td>10.28</td>
<td>m³</td>
<td>R$ 52.69</td>
<td>R$ 29.53</td>
<td>R$ 541.65</td>
<td>R$ 303.57</td>
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<td>Grauteamento dos blocos</td>
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<td>m³</td>
<td>R$ 219.27</td>
<td>R$ 400.41</td>
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<td>Ferragem de reforço em alvenaria: 2 barras bitola 5mm CA-50 (total 65m)</td>
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<td>11.07</td>
<td>kg</td>
<td>R$ 4.37</td>
<td>R$ 5.09</td>
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<td>Impermeabilização da sapata com cimentagem e pintura bituminosa (topo da sapata)</td>
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<td>10.28</td>
<td>m³</td>
<td>R$ 28.19</td>
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<td>Lona de polietileno 4x3m de baixo da sapata</td>
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<td>un</td>
<td>R$ 16.00</td>
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<td>Forma para lajes de concreto em tábuas de madeira</td>
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<td>7.33</td>
<td>m³</td>
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<td>Concreto estrutural 20Mpa em duas lajes de 2m x 2m x 9cm</td>
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<td>m³</td>
<td>R$ 260.60</td>
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<td>Ferragens – malha 20x20 bitola 4.2mm – 2 peças de 2m x 2m</td>
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<td>5.62</td>
<td>kg</td>
<td>R$ 4.34</td>
<td>R$ 1.55</td>
<td>R$ 4.34</td>
<td>R$ 24.39</td>
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<tr>
<td>1.13</td>
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<td>Improvisação de laje</td>
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<td>4.45</td>
<td>m³</td>
<td>R$ 28.19</td>
<td>R$ 35.81</td>
<td>R$ 125.45</td>
<td>R$ 159.35</td>
<td>R$ 284.30</td>
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<tr>
<td>1.14</td>
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<td>Alvenaria de bloco de concreto de 19cm aparente (12 fileiras, fileira superior em bloco canaleta)</td>
<td></td>
<td>26.00</td>
<td>m³</td>
<td>R$ 52.69</td>
<td>R$ 29.53</td>
<td>R$ 1,370.11</td>
<td>R$ 767.87</td>
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**Empreiteira**
G21
G49
G64 P0.050000
M6 T1.000000
(Tool Number: 1)
(7.998 mm dia. slot drill)
G43 H1.000000
G0 Z30.000000
M3 S19000.000000
G04 P10.000000
G1 F9999.000000 X580.651100 Y1082.640700 Z10.000000
G1 F2000.000000 X580.651100 Y1082.640700 Z1.500000
G1 F4000.000000 X568.027300 Y1082.640700 Z1.500000
G1 F4000.000000 X568.027300 Y1123.741600 Z1.500000
G1 F4000.000000 X568.027300 Y1123.741600 Z1.500000
G1 F9999.000000 X568.027300 Y1123.741600 Z10.000000
G1 F2000.000000 X607.366700 Y1123.741600 Z1.500000
G1 F4000.000000 X596.064000 Y1107.778300 Z1.500000
G1 F4000.000000 X594.677400 Y1105.816400 Z1.500000

Note: Pressing OK will commit any change you make above to the object, but if the object is parametric, these changes will be overridden on recompute.
What I learned:

• Fabricating is EASY
• Cost control is very precise
• Lots of optimizations possible
• A big part of the production chain is under control
• Lots more to do: integrate electrical appliances, make doors and windows, cut plastic pieces too, etc
• Give less to professional builders and more to the community. Building houses is FUN
• Experimentation, hacking, actual building and fun are back into architecture
Thanks for watching!

FreeCAD

http://www.freecadweb.org
http://forum.freecadweb.org
Facebook, Google+, etc...

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