Graduation Plan

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Master of Science Architecture, Urbanism & Building Sciences
# Graduation Plan: Architecture Engineering – Robotic Building

## Personal information

<table>
<thead>
<tr>
<th>Name</th>
<th>Karim Daw</th>
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<tbody>
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## Studio

<table>
<thead>
<tr>
<th>Name / Theme</th>
<th>Robotic Building</th>
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<tbody>
<tr>
<td>Teachers / tutors</td>
<td>Henriette Bier, Sina Mostafavi</td>
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<tr>
<td>Argumentation of choice of the studio</td>
<td>Advocating that robotic building provides a paradigm shift in architecture and construction</td>
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## Graduation project

<table>
<thead>
<tr>
<th>Title of the graduation project</th>
<th>“Non Standard Big Timber”</th>
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### Goal

<table>
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<tr>
<th>Location:</th>
<th>Berlin, Germany</th>
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<tr>
<td>The posed problem,</td>
<td>The Building industry is one of the most responsible sectors for the ever-increasing danger of our carbon footprint. An industry that is in constant demand to build more. Specifically, with the rising population and their desire for affordable housing, their seems to be a dire need for an all-encompassing sustainable solution that tackles both these problems head on.</td>
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<tr>
<td>research questions and</td>
<td>The question is, can advanced timber construction prove to be an established sustainable building methodology that could potentially become a viable futuristic building material. Today more than ever, material and fabrication research into wood construction could serve to be a viable investment, both economically and ecologically. By switching to wood, we could reduce the emissions from the construction industry by up to 31 percent, according to a study from the Yale School of Forestry and Environmental Studies.</td>
</tr>
<tr>
<td>design assignment in which these result.</td>
<td>Almost three decades after the fall of the Berlin Wall in 1989, the city is grappling with a growing housing</td>
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shortage, with property prices up 20.5 percent in 2017 alone, property consultancy Knight Frank said. Berlin leads the way as the German metropolis with the largest shortage of affordable apartments. Over 310,000 apartments are needed in the next decade to satisfy this increasing need for housing. I intend to create a ‘Object Oriented’ housing system, an aggregation of pre-fab customized housing units all taking into account the diverse needs of the users. The result will be a complex housing system tailored to the individual needs of the users. The computational process will involve research into agent based solution for goal oriented configuration of geometry as well as environmental and structural optimization feedback to inform the entire system.

This investigation is a twofold issue addressing the following:
1. The growing housing crisis in Europe, with the demand for new homes exceeding the current supply.
2. How wood could possibly be an alternative to current construction materials to mitigate the large carbon

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<tr>
<th>Process</th>
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<tr>
<td><strong>Method description</strong></td>
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Graduation Plan
1. Develop a tool to develop housing modules dependent on user’s needs and desires
2. Design a framework for the organizational strategy. What are the rules of the game? How do these
Spaces configure
3. Zoom in to the scale of materialization, how do these modules get fabricated.
4. Component logic, how do these modules connect to one another.
5. Validating the structural integrity throughout the process and feeding the results back into the system
with the hope of creating iterative design
6. Developing environmental tools that give feedback as to the performance of the iterations to again feed
**Literature and general practical preference**

Reflection
Relevance
The environment and how we impact it as a society should be at the forefront of our concerns. This pertains to all large industries in existent and particularly the building industry. Innovation in construction material usage are key in achieving this. Therefore, a thorough investigation into technology pertaining to the use of timber seems to be a viable and interesting area to explore. With the use of technological advances in construction such as, robotic fabrication design and operation, one could feasible optimize the way standard constructing is tackled as well as opt for newer modes of non-standard solutions. Mass construction and tailor fitting spatial and geometric needs can be achieve with automated construction solutions. One could argue by this route of optimized tailored architecture, one could economically justify these solutions as being financially optimized as well, allowing for a wide spread impact on the continued rise of our building need, more specifically: the housing need. The global housing crisis is a hot button issue of today that architects and future thinkers can have an impact on.

Time planning
1. Introduction
2. P1 presentation preparation
3. Design simple module, take into account connections
4. Create Attraction repulsion model
5. based on basic archetypes embedded in each module
7. Insert into a test site to test scale and residential functions into system
9. Develop documentation tools for automatic drawing and Tool Path generation
10. Prototype fabrication of Timber Elements Research Pavilion
11. Develop Logic of growth solver for timber frames
12. Continue Previous
13. Test sample simulation of growth solver and analyze bugs in algorithm
14. P2 Presentation Preparation (Documentation of computational and site research)
15. Diagram Site in Berlin, infrastructure, surrounding functions
16. Determine surrounding assets and sketch into general masterplan
17. Determine design domain based on surrounding buildings and site lines
18. Diagram various design domain boundaries (circulation, private vs public, porosity and green, commerce/business)
19. Massing Model on designated site
20. P2 Presentation
21. Begin Design development within different scales (macro,meso,micro)
22. Finalize local configurations of housing units
23. Refine technical explorations into fabrication techniques
24. Begin development of third and final prototype
25. Patch updates on timber growth solver
26. Document algorithmic procedure with diagrams
28. Initialize 1:1 prototype in DIA, Dessau Institute of Architecture
29. Evaluate results
30. Begin running structural simulations on selected housing units
31. Explore global configurations and begin finalizing configurations
32. Allocate mixed use functions and apply same/or adapted configuration logic
33. Run simulations on environmental factors and energy usage
34. Establish robust feedback in entire system
35. Document results
36. Prepare for P3
37. Mock Plans/sections/Elevations/Axons/Detail Sections/Models
38. **P3 Presentation**
   (Plans/sections/Elevations/Axons/Detail Sections/Models)
39. Initialize final production phase of pragmatic deliverables
   (Plans/sections/Elevations/Axons/Detail Sections/Models)
40. Plan for new modes of representation (diagrams to explain concept better)
41. Finalize prototype (if Necessary) and/or initialize 4rth prototype!
42. Finalize all algorithmic workflows for structure
   analysis/environmental/energy/configuration/archetype satisfaction factor*)
43. Prepare for P4:
   (theoretic and thematic support of research and design
   final reflection on architectonic and social relevance
44. site 1:5000 / 1:1000
45. plan ground level 1:500
46. plans elevations, sections 1:200 / 1:100
47. part of the building, plan and drawings 1:50
48. façade fragment with hor. and vert. cross-cut (on an appropriate scale)
49. details
50. **P4 Presentation**
51. Finalizing
52. Finalizing
53. Finalizing
54. Finalizing
55. Finalizing
56. **Final Graduation Presentation**