Graduation Plan for AE students

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Studio
Name of studio: Architectural Engineering Graduation Studio 12
1st Teacher: Job Schroën
2nd Teacher: Martijn Stellingwerf
3rd Teacher: 
Argumentations of choice of the studio: My fascination for new materials and fabrication methods was the main reason for choosing the Architectural Engineering Studio. By implementing these new technologies in architecture a more sustainable future can be realized.

Title
Creating new architecture, carbon fiber reinforced composite introduced as structural material.

Graduation Project

Problem Statement
The way we look at large-span structures nowadays is how to build them. In what way we can use steel and concrete to create them. Innovations in fabrication methods have brought up a different way of thinking; with what should we build them? Are concrete and steel still the best materials for these structures in the 21st century? The use of these materials always coincides with secondary materials to protect them against weather and climate. In the last decades, plastics are increasingly used in the façades of buildings, due to their material properties. With the arrival of carbon fiber reinforced composites the contemporary materials for a building structure can now be questioned. Due to its high strength/weight ratio and weather resistant properties it surpasses the use of concrete and steel in large-span structures. In other industries, such as the automotive and aviation industry, carbon fiber has already shown its potential. With the help of new forms we can use this material to build lighter and stronger structures, which also have a better durability.

Objective
The result of this graduation project will be presenting the implementation of carbon fiber as a new structural material in architecture. To make this more manageable, the focus for this research will lie on creating a large-span structure with carbon fiber reinforced composites.
**Overall Design Question**
*How to implement carbon fiber reinforced composite as a structural material for a large-span structure in architecture?*

**Thematic Research Question**
*How can we create a lightweight membrane structure for the market square Binnenrotteplein in Rotterdam, using a structural frame of carbon fiber reinforced composites?*

**Sub-questions**

**Material:**
- Why carbon fiber?
- What resins can we choose from?

**Fabrication:**
- What technology can be used to fabricate components?
- What is the maximum scale?
- How is it used in other industries?

**Structure:**
- Which large-span structures are already built?
- What structures are suited for carbon fiber?
- How can carbon fiber be used?
- Which materials can be combined within the structure?

**Form finding:**
- How can we create forms with bend-active carbon fiber rods?
- Which programs effect the form of the structure?
- How can we justify the structures strength?

**Methodologies**
- Literary study
- Interviews with automotive industry
- Interviews with infrastructure industry
- Research by design
- Computer simulations
- Prototyping
Planning

Relevance
The advancing fabrication techniques require a different material. The combination of carbon fiber with these new techniques will create a whole new era of architecture. Building forms and structural geometry, which never could be realized, are then within reach. Also on a sustainable level it has a lot of potential, because architects can design lighter and stronger buildings with fewer materials. Next to that the recycling of carbon fiber is a lot less energy consuming and there is almost no maintenance required during its lifetime.

Literature