Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences

Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Sjoerd van Greevenbroek
Student number	4251180
Telephone number	+31639779416
Private e-mail address	slvangreevenbroek@gmail.com

Studio	
Name / Theme	Architectural Engineering
Teachers / tutors	Mauro Parravicini, Paddy Tomesen, Pieter Stoutjesdijk
Argumentation of choice of the studio	Research and design from fascination, free choice of project, innovation in construction methods.

Graduation project	
Title of the graduation project	Folding structures – a kinetic solution
Goal	
Location:	No specific context
The posed problem,	A new construction method for freeform foldable structures has been developed based on the principles of origami and CNC milling. The proposed method can be implemented in many situations and in many configurations. The main advantages of the system are: • Geometrical freedom • Kinematic properties • Low process time • High adaptability • Flat-foldability • Transportability • Fast assembly time Many different functions can benefit from these characteristics, specifically kinetic structures. These kinetic structures can be categorized in:

	either deployable kinetic structures, dynamic kinetic structures or embedded kinetic structures, as described by Ramzy and Fayed (2011). These different categories will be scored against the characteristics of the proposed method in order to come to a fitting match. The fitting kinetic category can then coupled to trends and context. Ultimately the goal is to be able to describe the process in reverse, starting from a clear problem statement, towards a solution (the proposed method) at p4.
research questions and	How can a freeform foldable structure based on the principles of origami and CNC milling be implemented and which problems can it solve? Thematic research question: How to create a flat sheet of layered material that folds into a freeform building module using CNC milling and the principles of origami?
design assignment in which these result.	The goal is to find a suitable implementation for the proposed technique and find out which problems can be solved using its kinetic properties. Near p4, the process should be able to be told in reverse, starting from problem statement and ending in a solution (the proposed method).

Process

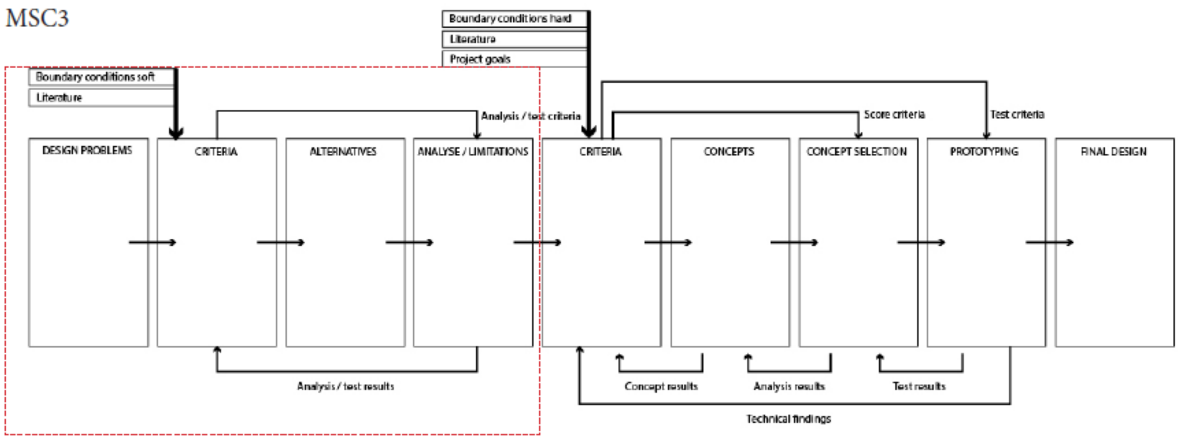
Method description

The main research methods which will be used are research by design, literature and case studies. A methodology framework has been formulated as shown in the figure below, which I will follow during my graduation.

Literature regarding modular building and foldable structures will be conducted and case studies will offer a reference of possibilities.

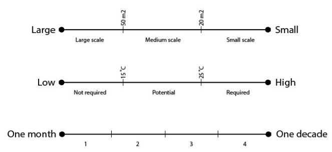
I will start with the question how foldable structures can be implemented and which problems it could solve. At the end of my graduation I will be able to tell the process the other way around. In order to find a suitable implementation, a SWOT analysis of the proposed construction method has been applied. Different possible implementations have been scored using the SWOT analysis in order to find how well they suit the proposed method.

A large part of the research will be research by design, by conducting formfinding studies to test if and which shape give the best solution to the problem. The findings will be compared and the outcome will provide a conceptual framework for the further design process. During the design phase of the graduation project, after the P2-presentation, both the conceptual framework and the program of requirements will be combined into an integrated architectural design. Throughout the whole graduation process, case studies will be looked into.



Project parameters

- Dimension
- Thermal comfort
- Lifespan



Strengths (Not useful ☐☐☐☐☐ Useful)

- Geometrical freedom ☐☐☐☐☐
- Kinematic properties ☐☐☐☐☐
- Process time ☐☐☐☐☐
- Adaptability ☐☐☐☐☐

Weaknesses (Issue ☐☐☐☐☐ No issue)

- Failure creases / Dimension ☐☐☐☐☐
- Connections between modules ☐☐☐☐☐
- Thermal comfort ☐☐☐☐☐

SWOT

Opportunities (Not useful ☐☐☐☐☐ Useful)

- Flat-foldability ☐☐☐☐☐
- Transportability ☐☐☐☐☐
- Assembly time ☐☐☐☐☐

Threats (Issue ☐☐☐☐☐ No issue)

- Thickness panels / Flat-foldability ☐☐☐☐☐
- Structural autonomy ☐☐☐☐☐
- Manageability / Weight ☐☐☐☐☐

Literature and general practical preference

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Reflection

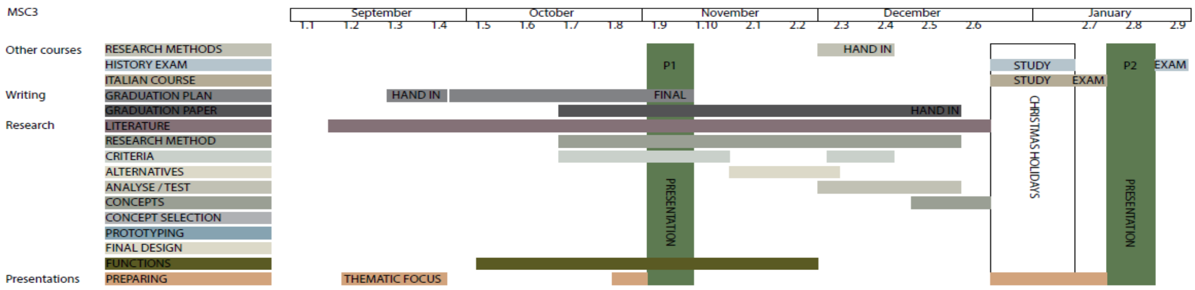
A new construction method for freeform foldable structures has been developed based on the principles of origami and CNC milling. The proposed method can be implemented in many situations and in many configurations. The main advantages of the system are:

- Geometrical freedom
- Kinematic properties
- Low process time
- High adaptability
- Flat-foldability
- Transportability
- Fast assembly time

Many different functions can benefit from these characteristics, specifically kinetic structures. These kinetic structures can be categorized in:
either deployable kinetic structures, dynamic kinetic structures or embedded kinetic structures, as described by Ramzy and Fayed (2011). These different categories will be scored against the characteristics of the proposed method in order to come to a fitting match. The fitting kinetic category can then coupled to trends and context. Ultimately the goal is to be able to describe the process in reverse, starting from a clear problem statement, towards a solution (the proposed method) at p4.

Time planning

A time planning has been attached on the following page.


MSC3
September
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November
December
January
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Other courses
RESEARCH METHODS
HISTORY EXAM
ITALIAN COURSE
Writing
GRADUATION PLAN
GRADUATION PAPER
Research
LITERATURE
RESEARCH METHOD
CRITERIA
ALTERNATIVES
ANALYSE / TEST
CONCEPTS
CONCEPT SELECTION
PROTOTYPING
FINAL DESIGN
FUNCTIONS
Presentations
PREPARING
HAND IN
FINAL
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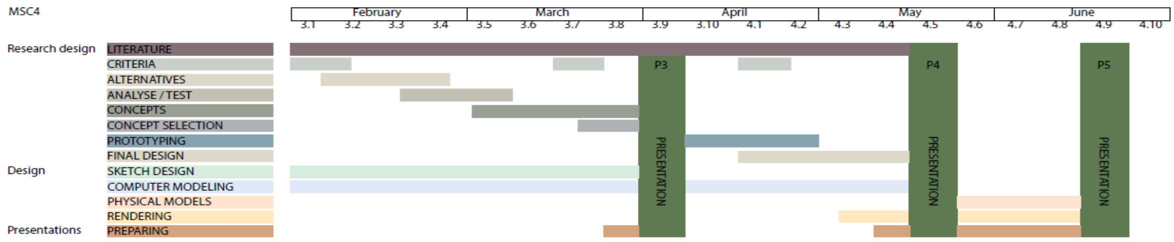
THEMATIC FOCUS
P1
PRESENTATION
STUDY
STUDY
EXAM
CHRISTMAS HOLIDAYS
P2
PRESENTATION
EXAM


MSC4
February
March
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3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 3.10 4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 4.10
Research design
LITERATURE
CRITERIA
ALTERNATIVES
ANALYSE / TEST
CONCEPTS
CONCEPT SELECTION
PROTOTYPING
FINAL DESIGN
Design
SKETCH DESIGN
COMPUTER MODELING
PHYSICAL MODELS
RENDERING
Presentations
PREPARING
P3
PRESENTATION
P4
PRESENTATION
P5
PRESENTATION