

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: All tracks

Personal information	
Name	Alkiviadis Oikonomidis
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Studio		
Name / Theme	Sustainable Design Graduation Studio ReStruct Research Group	
Main mentor	Simona Banchi	Structural Design & Mechanics
Second mentor	Charalambos Andriotis	Structural Design & Design Informatics
Argumentation of choice of the studio	My personal interest in the impact of heatwaves on building envelope and structural grid bearing structures and on indoor thermal comfort and energy consumption, together with the desire to use current digital tools combining statics and physics give me motivation to produce alternatives for exterior shading systems.	

Graduation project	
Title of the graduation project	“Multi-objective optimization of external shading system using genetic algorithm based workflow to enhance energy efficiency of existing building envelope.”
Goal	
Location:	Tower in port of Athens, Greece
The posed problem,	<p>During a facade design, due to many different disciplines getting involved in the design process, there is usually lack of communication concerning different aspects/criteria of the facade design and of the relationships between them in common-criteria procedures. What happens with the extra criteria hazardous events like heatwaves add to this list?</p> <p>The creation of a digital design tool for defining hierarchies of criteria and tracking conflicting criteria during the design procedure would contribute to that. The architectural designer could generate forms and structures based on different criteria goals (boundaries) and their hierarchies. The goal is firstly to achieve instant inter-discipline feedback and secondly to easily and quickly define an optimal solution or families of solutions based on selected criteria goals.</p>
research questions and	<p>Main Question:</p> <p>How can a genetic algorithm-based workflow be effectively employed in the multi-objective optimization of a shading system to improve the energy efficiency of an existing building envelope?</p>

	<p>Sub - questions:</p> <p>I. What are the primary typologies of facades and how can they be classified based on their materials, connection details and functions?</p> <p>II. What is resilience and how can it be quantified?</p> <p>III. How to formulate a genetic algorithm-based multi-objective optimization workflow?</p> <p>IV. How can a digital design tool be implemented in a preliminary design phase of a shading system to enhance the thermal resilience of an existing curtain wall system and provide interdisciplinary feedback to a design team?</p>
<p>design assignment in which these result.</p>	<p>The main objectives are for the researcher to get familiar with climate design and facade engineering and the development of a digital design tool for the preliminary design of such a shading system. It is envisioned as an assisting tool for evaluating a buildings' energy performance and further improve its behavior especially against heat stresses. The goal is to create a tool for this specific case study but also to be able to implement the same workflow to more buildings of different scales and heights in future projects.</p>
<p>Process</p>	
<p>Method description</p> <p>First a digital workflow consisting of five separate steps is to be defined in order to integrate a BIM model into Grasshopper interface, translate the geometries of a case study building into an energy model, evaluate the existing shading system of the case study and finally design and optimize the proposed parametric model.</p>	

Literature and general practical references

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