

Adaptable Architecture for on-site Energy Resources



Speerpunt
BOUW

RESEARCH SCHOOL
INTEGRAL DESIGN OF STRUCTURES

A digital approach for the conceptual design of reconfigurable structures

Subject

The research focuses on the integration of movable and reconfigurable elements in large structures (such as atria, canopies or large roofs), in order to make them adaptable. The investigated adaptability refers to the capacity to be responsive to changing daily and seasonal climatic conditions by aiming at the use of on-site energy resources to reduce the need for imported energies. Modular structures are a subject of main interest, with specific focus on foldable and deployable modules. The use of on-site energy resources is mainly investigated with respect to passive thermal and daylight comfort.

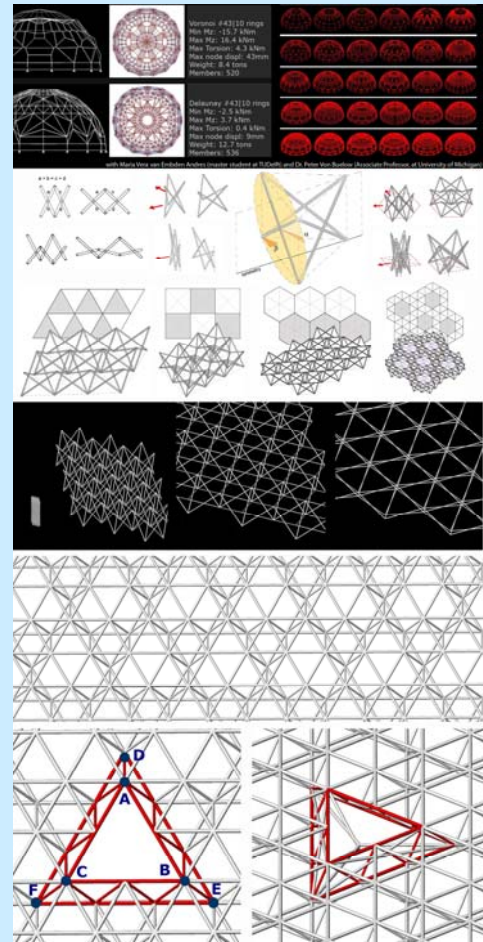
Goals

To investigate the potentials of kinetic modules for large structures with respect to the use of on-site energy resources and provide a digital approach to support the designer in the conceptual design phase.

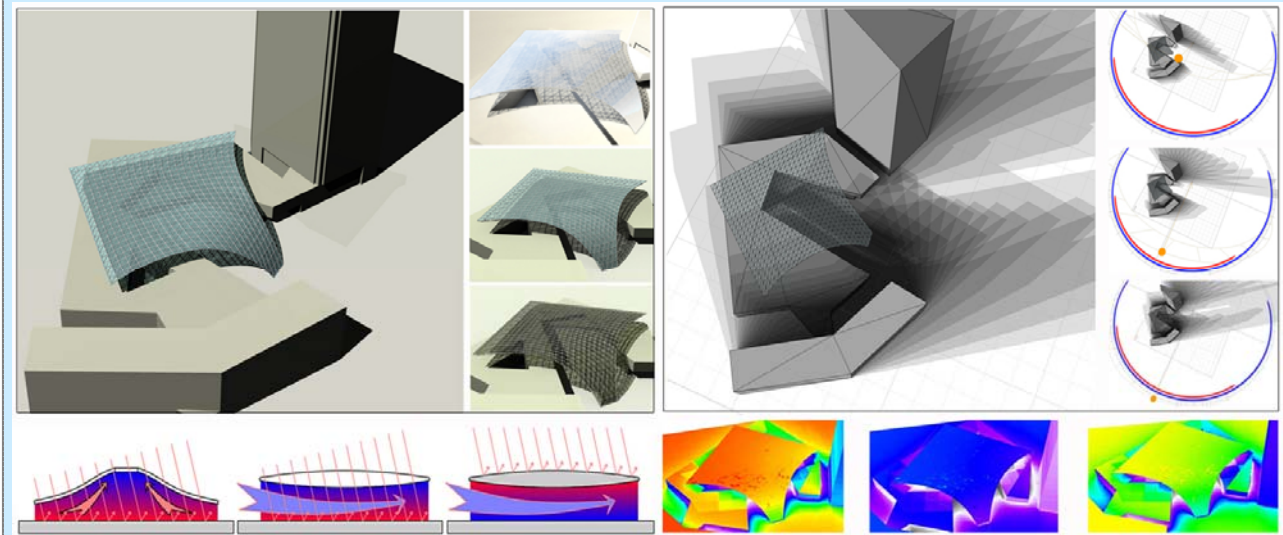
Aiming at a performance oriented design support, parametric modeling is discussed based on its capacity for creating design alternatives while managing the complex interrelations. However the performance evaluation of the design alternatives needs the integrations of other digital techniques, among which specific attention is given to genetic algorithms as support in searching for optimal solutions.

Expected Results

A digital approach consisting of a method and a concept for the related digital environment, aimed at supporting the designer by providing a parametric work environment that integrates performance evaluations.



A case study: the Vela Roof in Bologna, Italy [architectural design by Open Project Office]



3TU.

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Adaptable Architecture for on-site Energy Resources **Digital Approach for the Conceptual Design of Reconfigurable Structures**

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Subject

Adaptability in architecture is the capacity of a building to be responsive to a changing context and kinetic architecture is a possible way for reaching this aim. Among the different needs for adaptability for which kinetic architecture can be designed, the research focuses on large structures (such as canopies, roofs, atria) by investigated their passive thermal comfort with respect to the ability of being responsive to the daily and seasonal changing climate factors. Integration of deployable, foldable and reconfigurable systems is explored with specific focus on modular structures.

Goals

To investigate the potentials of kinetic modules for large structures with respect to the use of on-site energy resources and provide a digital approach to support the designer in the conceptual design phase.

Research Question

With specific reference to the possible integration of reconfigurable modules for using on-site energy resources, how can the design of large structures (such atria, canopies, large roofs) be digitally supported?

Strategy

By focusing on their shared, the research investigates the domains of both passive solar strategies and reconfigurable structures. Among these latter, specific focus is given to deployable structures for which a hierarchical taxonomy has been developed to categorize the morphological principles, in order to facilitate the operative use of this knowledge during design processes. Design processes are investigated with reference to parametric modelling by means of its capacity for creating design alternatives. Those are explored based on performance evaluations and special attention is given to genetic algorithms as support in searching for optimal solutions. By focusing on performance oriented design processes, the research follows an active research methodology concerning the applications of the investigated subjects.

Expected Results

A digital approach consisting of a method and a concept for the related digital environment, aimed at supporting the designer by providing a parametric work environment that integrates performance evaluations.

Preferred Partners Applications / Sponsors

Collaborations with the practice and sponsoring by architectural offices have been formalized and are further expected.

Prime Publication / Prototyping

The research is being presented in international publications, scientific conferences and professional events.

Research Period

November 2006 - November 2010