

### Building zero energy districts in tropical climates. Development of design tools for morphology/comfort/energy coupled optimization.

Aymeric Delmas

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# Building zero energy districts in tropical climates. Development of design tools for

morphology/comfort/energy coupled optimization.

Coupling multiple weather-based simulation models and tools via a Rhino-Grasshopper platform.

**AYMERIC DELMAS** 

PhD candidate at PIMENT Research Engineer at IMAGEEN aymeric.delmas@imageen.re

# Approach

The couple Rhino-Grasshopper is a **parametric modelling** tool that is able to algorithmically control 3D models and

geometrically optimize them to any defined criteria.

Grasshopper as a script-based Rhino plugin makes generating **complex geometries** easy. Architectural building designs belong to these complex geometries and are nowadays a reality.

Environmental sustainable building design requires the use of **multiple weather-based** 

**simulation tools** to assess the effect of the built environment on the local weather conditions.



Algorithmically generated and controlled building form in Rhino-Grasshopper Khabazi\_Algorithmic modeling with Grasshopper



Greater London Solar irradiation Authority Building optimized building form 2013-Caruso\_Optimal theoretical building form to minimize direct solar irradiation.

**OJECTIVES** How to design bioclimatic neighborhoods in dense tropical urban areas? The **objectives** of the presented

London

Foster and Partners

Current design practice for buildings located in dense urban tropical areas imply multiple, independent and multi-scale models, tools and interfaces making continuity of the overall building environmental study (from mesoscale to microscale) impossible. This **modeling issue** makes the efficiency of passive design strategies adapted to tropical climates **uncertain**. thesis are:To take into account both thermal

- and airflow transfers at the urban scale
- To improve currently available

# METHODOLOGY – DESIGN PROCESS

"Design is the process of realizing intentions."

Developing design tools for morphology/comfort/energy coupled optimization involves a development methodology following a **global design process.** 

This thesis' methodology is built around selected design principles and **experiences** drawn from zero energy built and monitored projects in the **tropical climate of La Reunion**. The methodology can be illustrated by the following spiral.

#### From zero energy building design experience to passively optimized urban form.



# EXPECTED RESULTS

The expected achievement of this thesis is a **Coupling platform**, solving continuity (temporal and spatial) issues of current **global environmental study** of buildings in tropical urban areas.

### Coupling platform



Thesis director:Pr. François Garde, PIMENT, University of La RéunionThesis co-director:Marjorie Musy, CRENAU, University of Nantes

- models ;To couple them ;
- To make them suitable for urban tropical microclimate simulation .
- To develop a unique, reactive and flexible environmental models coupling platform via Rhino-Grasshopper.

It will use the great range of weather-based simulation tools to assess the impact of the urban microclimate on buildings, occupants and pedestrians' comfort and ultimately **optimize the urban form to passive design strategies**.

### Global environmental study and optimized building form



