USER DOCUMENTATION

INTRA**LATTICE**

CORE MODULES

Version **0.7.5**

SYSTEM REQUIREMENTS

Operating System:	Windows 7 or 8 (64-bit recommended)
RAM:	8GB or more
Video Card:	OpenGL 2.0 capable video card
CPU:	No more than 63 CPU cores

INSTALLATION

The following **required software** should be installed on your system.

- Rhinoceros 5
- Grasshopper

Next, if you haven't yet, download the latest version of INTRA**LATTICE**

- Intralattice

To install, simply drag the 'IntraLattice.gha' file into your Grasshopper viewport. A new toolbar will appear.

SUPPORT

If you have any issues, or want to report a bug, please contact support@intralattice.com

BACKGROUND

The freedom of form enabled by 3D printing has allowed engineers to integrate new orders of complexity into their designs. The goal of this research was to develop **a set of CAD tools for generating solid lattice structures** within a design space. The software would be used to:

- Reduce volume/weight while maintaining structural integrity.
- Increase surface area as a means of maximizing heat transfer.
- Generate porosity in bone scaffolds and implants.
- Serve as a platform for design optimization.

In doing so, it should always output a watertight mesh suited for 3D printing. The lack of flexibility of current software solutions was the driving force behind this project. We wanted to develop a flexible platform more conducive to research, which would allow us to explore and experiment with lattice design at a deeper level. The obvious first step was to decide in which environment we would develop our system. Rhinoceros is known to be very open ended, having its own engine for interpreting scripts (Python, C# and VB), and a powerful plugin SDK (RhinoCommon). Rhinoceros' Grasshopper addon is an algorithmic modeling tool widely used in architecture which provides an ideal interface for systematic design. In this visual interface, parameters and function components are combined sequentially to carry out the design of 3D models. By developing a set of custom components for Grasshopper, we established a modular workflow for lattice design.

That being said, if you are not familiar with Grasshopper, you are highly encouraged to have a look at the latest Grasshopper Primer, to bring you up to speed.

DEVELOPMENT TEAM

McGill Additive Design & Manufacturing Laboratory

Aidan Kurtz
+ Lead developer of the CORE modules.
+ Documentation, website, video tutorials.
+ GitHub repository management.
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Yunlong Tang
+ Lead developer of the OPTIMIZATION modules (PhD Research).
+ Provided crucial insight at various stages of development.
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Prof. Fiona Zhao
+ Supervisor and head of the research lab.

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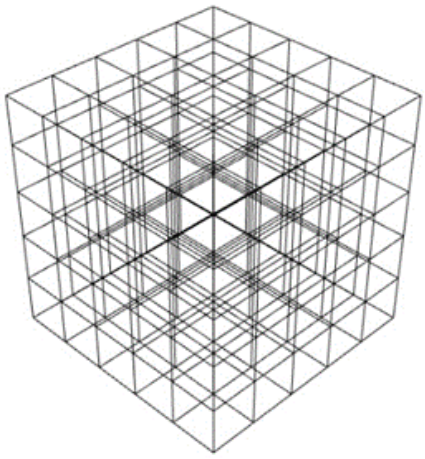
Section 1

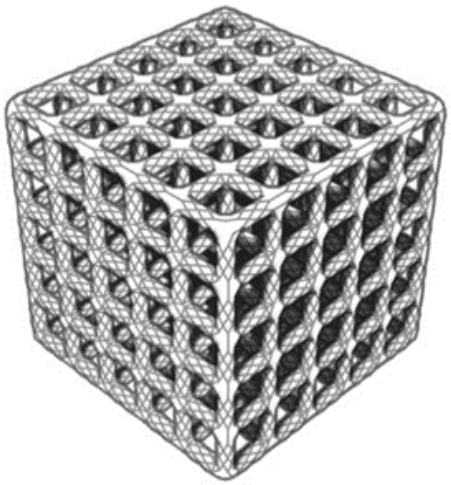
FRAMEWORK

CELL

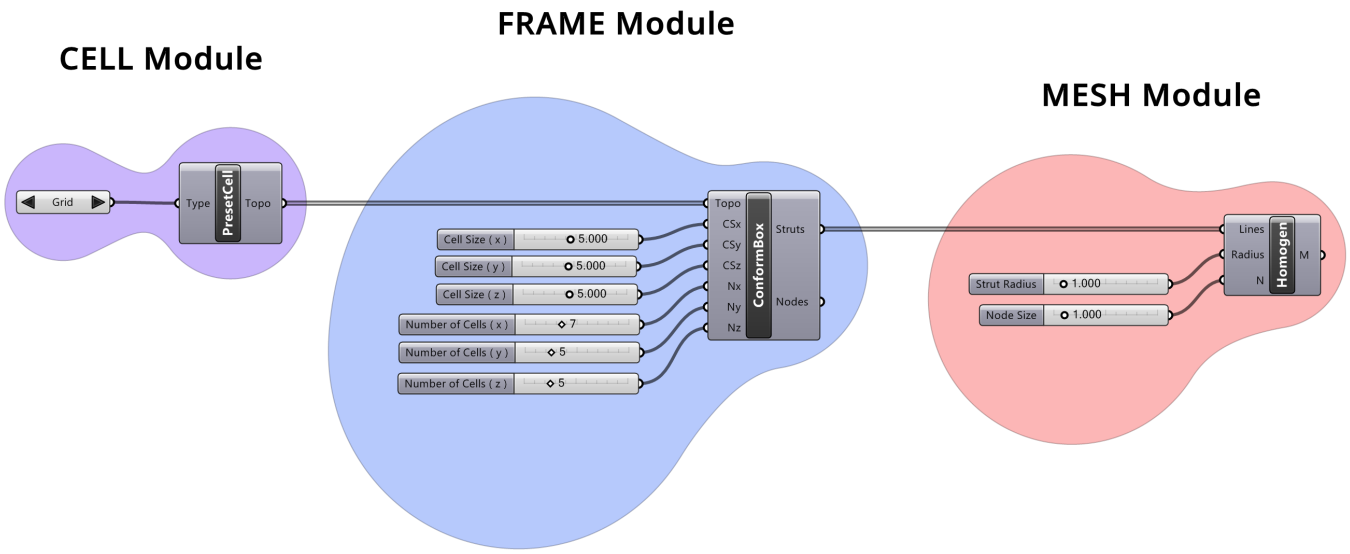
FRAME



MESH



The modular framework is quite straight-forward.

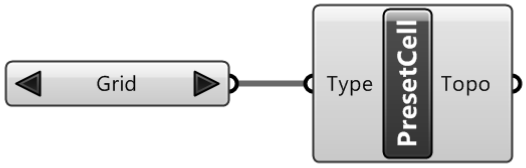


Section 2

CELL MODULE

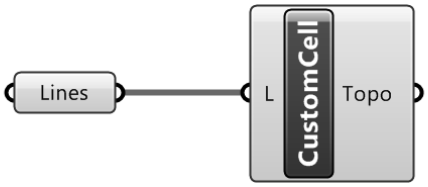
2.0 PRESET CELL

Description — Built-in selection of unit cell topologies.



2.1 CUSTOM CELL

This component can be used to pre-process a custom unit cell.



Description — Pre-processes a custom unit cell by check validity and outputting topology.

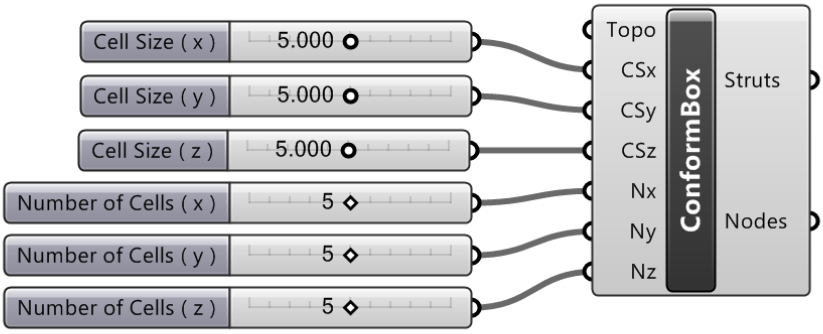
Talk about how to create cells: - in any cad software - in grasshopper - in python script

Section 3

FRAME MODULE

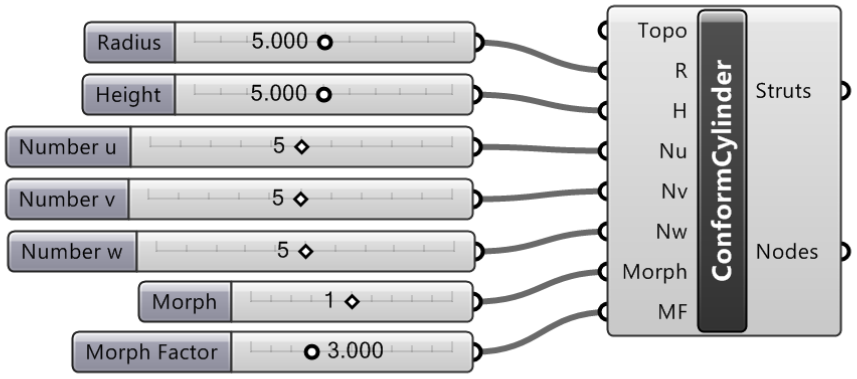
3.0 BASIC BOX

Description — Generates a lattice box.



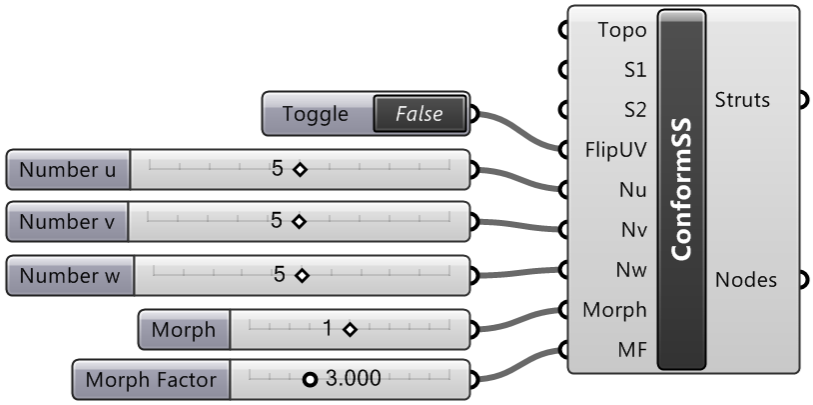
3.1 BASIC CYLINDER

Description — Generates a lattice cylinder.



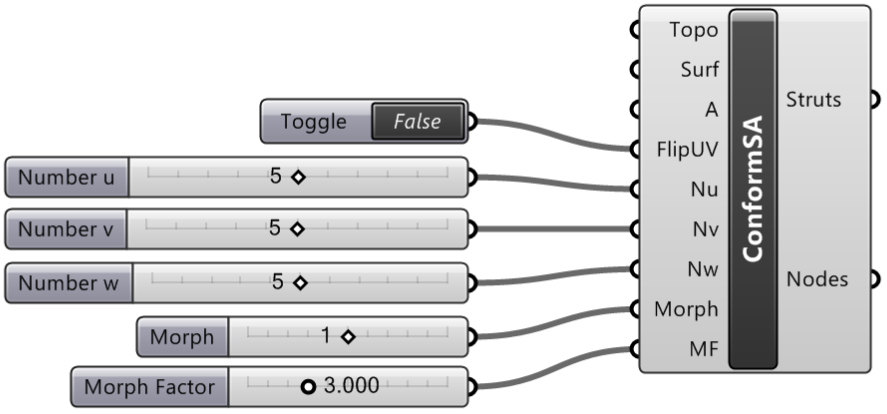
3.2 CONFORM SURFACE-SURFACE

Description — Generates a lattice cylinder.



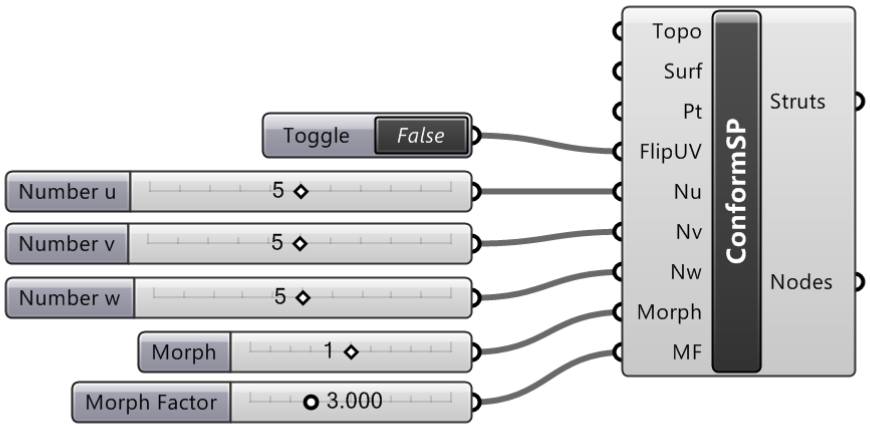
3.3 CONFORM SURFACE-AXIS

Description — Generates a lattice cylinder.



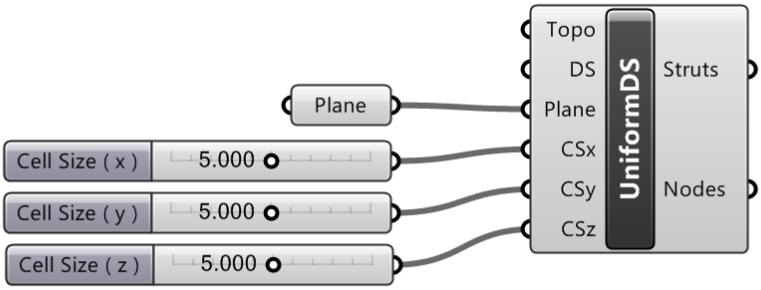
3.4 CONFORM SURFACE-POINT

Description — Generates a lattice cylinder.



3.5 UNIFORM DESIGN SPACE

Description — Generates a lattice cylinder.

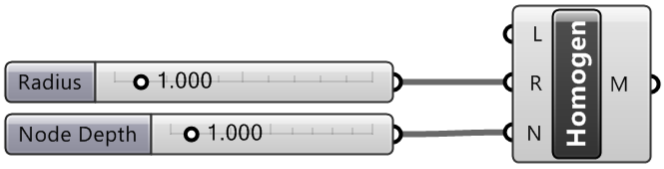


Section 4

MESH MODULE

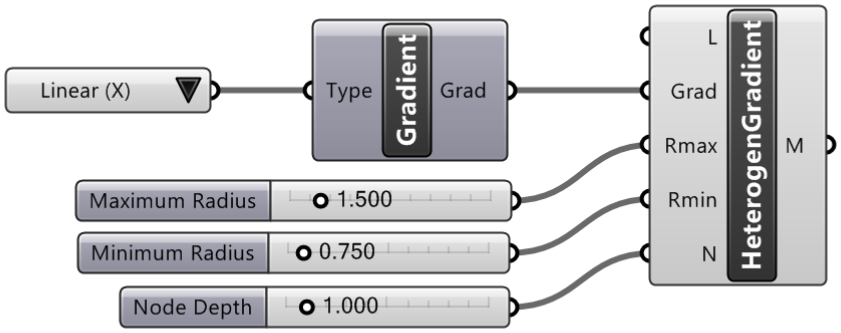
4.0 HOMOGENEOUS

Description — Generates a lattice cylinder.



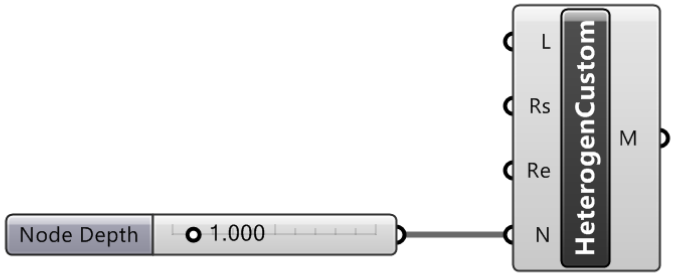
4.1 HETEROGENEOUS GRADIENT

Description — Generates a lattice cylinder.



4.2 HETEROGENEOUS CUSTOM

Description — Generates a lattice cylinder.

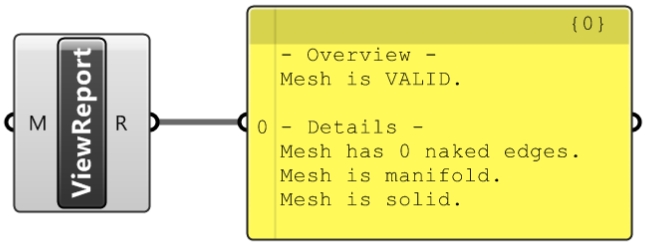


Section 5

UTILITY MODULE

VIEW REPORT

Description — Generates a lattice cylinder.



Section 6

CASE STUDIES