Venturial & PyVNT

SIMPLIFYING CFD CASE CREATION IN OPENFOAM

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About FOSSEE

- FOSSEE stands for Free/Libre and Open Source Software for Education.
- It’s a project based at IIT Bombay and supported by the National Mission on Education through ICT (Ministry of Education, Government of India).
- The main goal of FOSSEE is to promote the use of open-source software in academia, research, and industry, especially in India.
- Why? Because commercial software in engineering and science (like MATLAB, OrCAD, Ansys) is often very expensive and creates dependency. Open-source alternatives are free, customizable, and community-driven.

FOSSEE Contributes by:

- Developing and improving open-source tools
- Translating content into Indian languages Creating textbook companions (where solved examples from standard textbooks are recreated using open-source tools)
- Conducting workshops, hackathons, and internships for students
- In short, FOSSEE reduces barriers so students and researchers can learn and innovate without depending on costly proprietary tools.

About Venturial & PyVNT

- Venturial is a Blender addon that alleviates the effort to build OpenFOAM cases.
- Venturial seeks to procedurally introduce OpenFOAM’s case-building process to newcomers through instructive interfaces that are optionally customizable for the succinct needs of experienced users and graphically modifiable for domain-specific work.
- It provides an expedient workflow via interactive tools that facilitate OpenFOAM's case-definition rules without diminishing user control.
- PyVNT is a library to control Venturial's Node-Tree based data structure using Python.
- Primarily, PyVNT serves as a dependency to Venturial but it can also be used independently.
- PyVNT contains classes that define the Node-tree data structure and modules for manipulating it.

Motivation

Problem:

- Users find it cumbersome to write long case files for OpenFOAM from scratch
- Difficult to visualize mesh when user needs to write it out in a text file
- Steep learning curve for beginners
- No homogenous environment for making the workflow easier

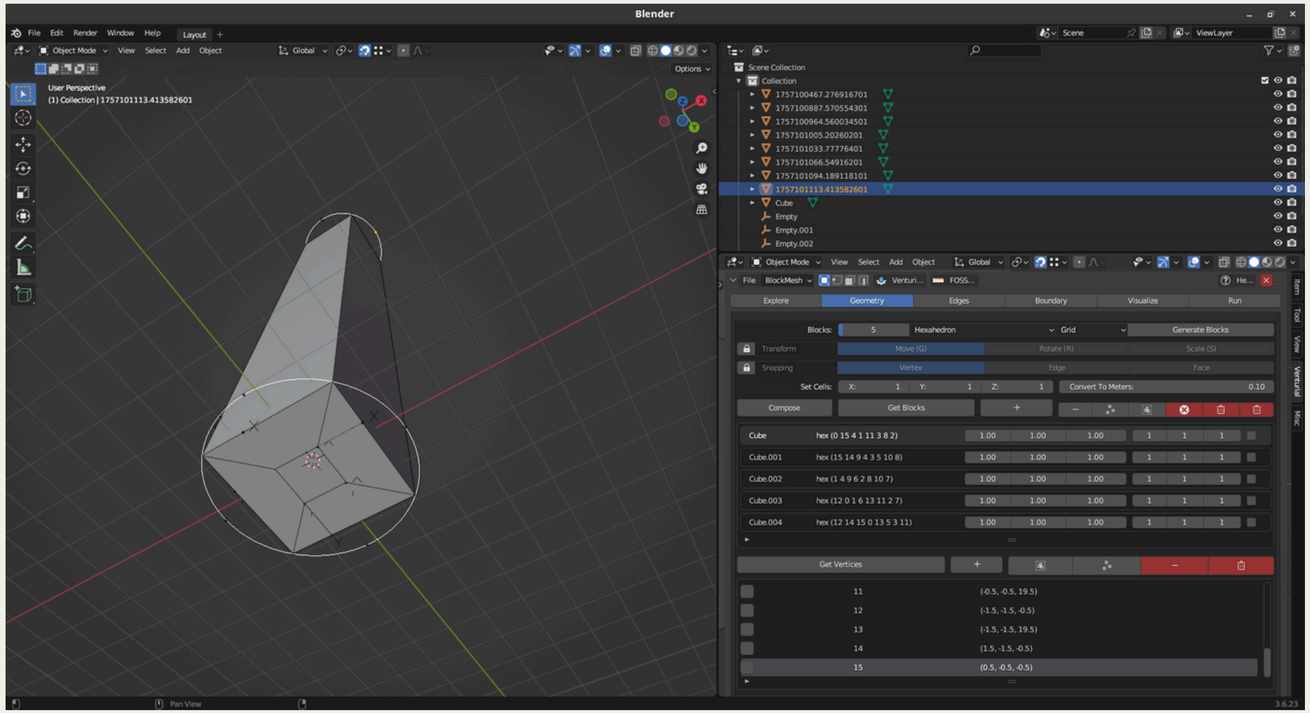
Venturial Features

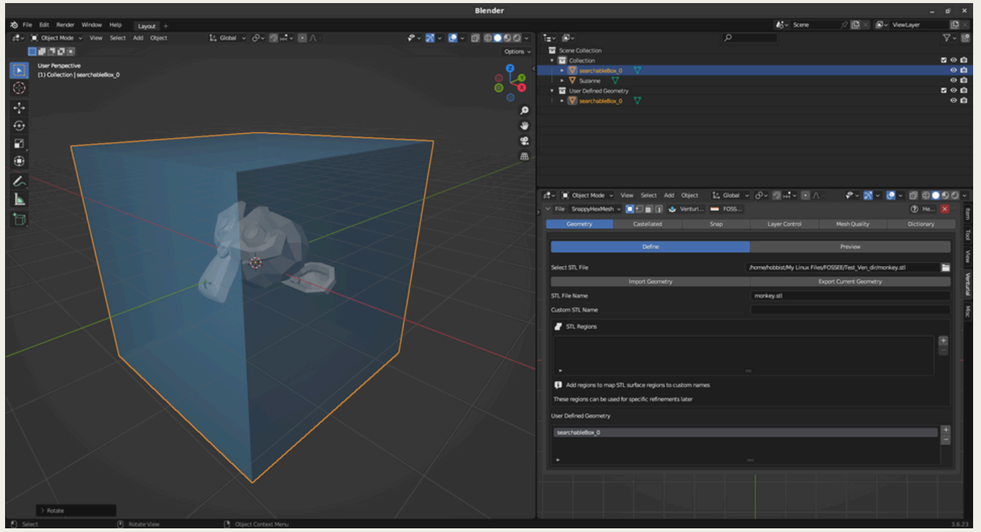
- Compose hexahedral primitives within Blender to generate blockmesh dictionary.
- Import CAD files into Blender and generate snappyhexmesh dictionary with Venturial's geometry setup tools.
- Import mesh dictionaries and convert geometry definitions to Blender-editable objects for modification and re-composition.
- Visualize mesh structural data with hovering annotations.
- Graphically customize solver parameters for domain-specific solution modeling.
- Use editable case file templates to populate an OpenFOAM case.
- Control and monitor solver execution.

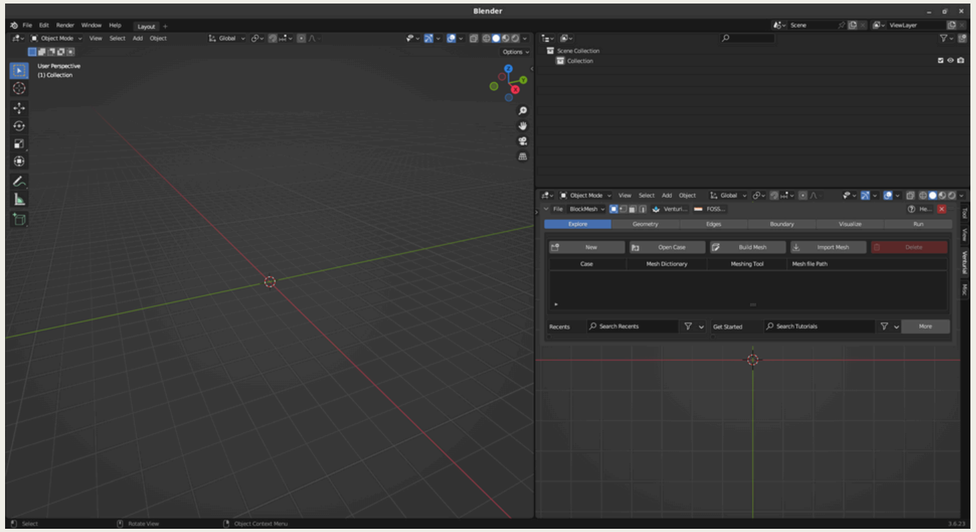
Venturial Features

Screenshots:

- General UI of Venturial
- Pipe Case
- SnappyHexMesh using Suzanne







PyVNT Features

- PyVNT: Python Venturial Node Trees
- Make Node trees that mimic the structure of OpenFOAM Dictionaries.
- Provide tools for conveniently manipulating trees with simple Python scripts.
- Generate serialised data for dynamically generating a graphical representation of trees.
- Parse YAML files and traditional OpenFOAM dictionary files into PyVNT node trees.
- Adds scripting capability for experienced users

PyVNT Examples

Examples:

OpenFOAM Dictionary	PyVNT Node Tree

`solvers`
`{`
`  p`
`  {`
`  solver  PCG, BNR;`
`  preconditioner  DIC;`
`  tolerance  1e-06;`
`  relTol  0.05;`
`  }`
`}`
	`solvers(Node_C)`
	`└── p(Node_C)`
	`  {`
	`  solver(Key_C) : PCG(Enm_P), BNR(Enm_P)`
	`  preconditioner(Key_C) : DIC(Enm_P),`
	`  tolerance(Key_C) : 1e-06(FloatProperty),`
	`  relTol(Key_C) : 0.05(FloatProperty),`
	`  }`

Closing Thoughts

- Venturial provides a good starting environment and a homogeneous Environment for using OpenFOAM
- PyVNT allows experienced users to manipulate case files in a simple manner
- PyVNT also allows any other developer to come up with their own GUI for OpenFOAM

Thank you!

QUESTIONS?

Venturial: https://github.com/FOSSEE/venturial
PyVNT: https://github.com/FOSSEE/pyvnt

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