Design/Practical Experience [EEN1010]
Department of Electrical Engineering
Final Report

Academic Year: 2021 - 22
Semester: 1

Date of Submission of Report: 19/11/2021

1. **Name of the Student:** Divyam Patel
2. **Roll Number:** B20EE082
3. **Title of the Project:** Algorithm Development for Computational Knitting
4. **Project Category:** 3
5. **Targeted Deliverables:** An implementation of an algorithm for computational knitting.
6. **Work Done:**
   Aim - The project aims to develop computer-aided knitting design software that allows freeform shaping and complex patterning with multiple types of threads.

   Theory :
   Recent developments in textile industries include digital and 3D textile manufacturing. Its application is not only limited to fashion and garments but in the engineering sector also like aerospace, automotive, defense sector. Functional properties such as electric, magnetic and thermal conductivity, light sensitivity, mechanical stiffness, or impact resistance can now be embedded in the fabric.
   Computational knitting is a modern technique that can transform 3D meshes, created by traditional modeling programs, directly into instructions for a computer-controlled knitting machine. Knitting machines can mandatory form knitted 3D surfaces from yarn. They also have some constraints on what they can fabricate. Given user-defined starting and ending points on an input mesh, the system incrementally builds a helix-free, quad-dominant mesh with uniform edge lengths, runs a tracing procedure over this mesh to generate a knitting path, and schedules the knitting instructions for this path in a way that is compatible with machine constraints.
   Computational knitting makes the process of knitting much better. It has got many advantages over traditional hand knitting like more strength of the material, fast stitching, more stretchable material, etc.

Methodology

Input design

⇩

Building KnitNet

⇩

KnitNet

⇩

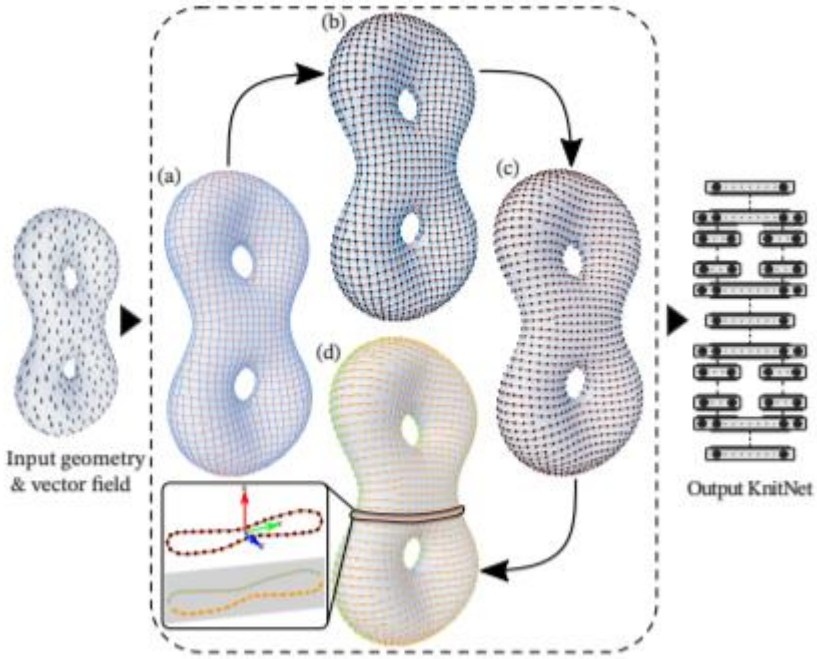
Generating machine instructions

⇩

Machine processing

⇩

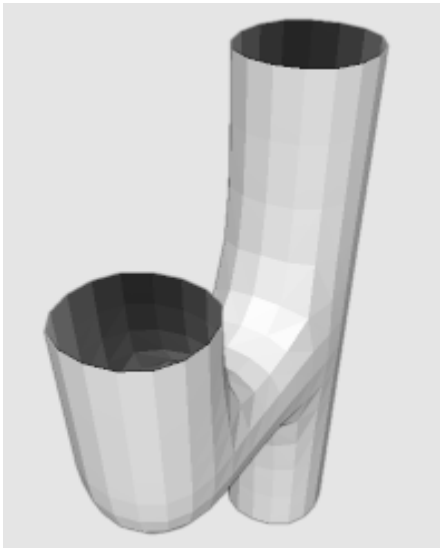
Output



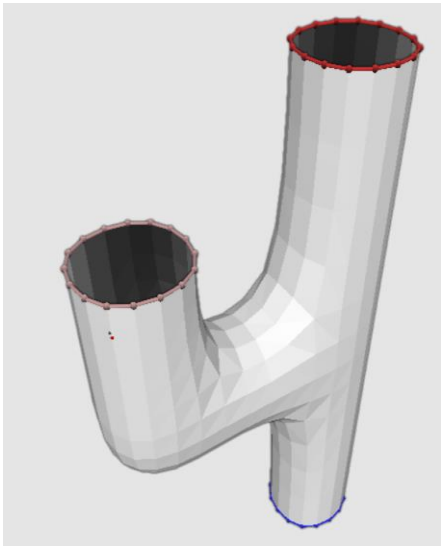
Steps involved in building the KnitNet from an input 3D mesh and vector field

Steps for creating Knitting :

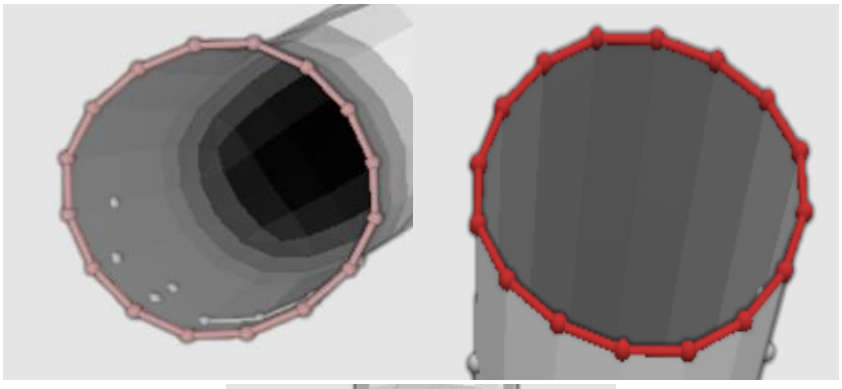
1. Adding Constraints

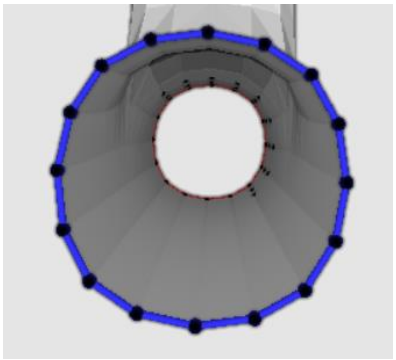


3D view of the model

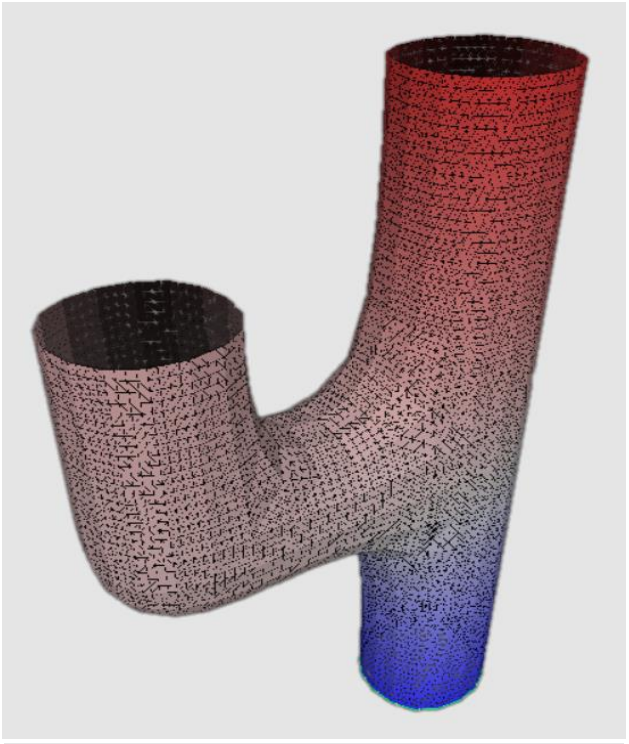


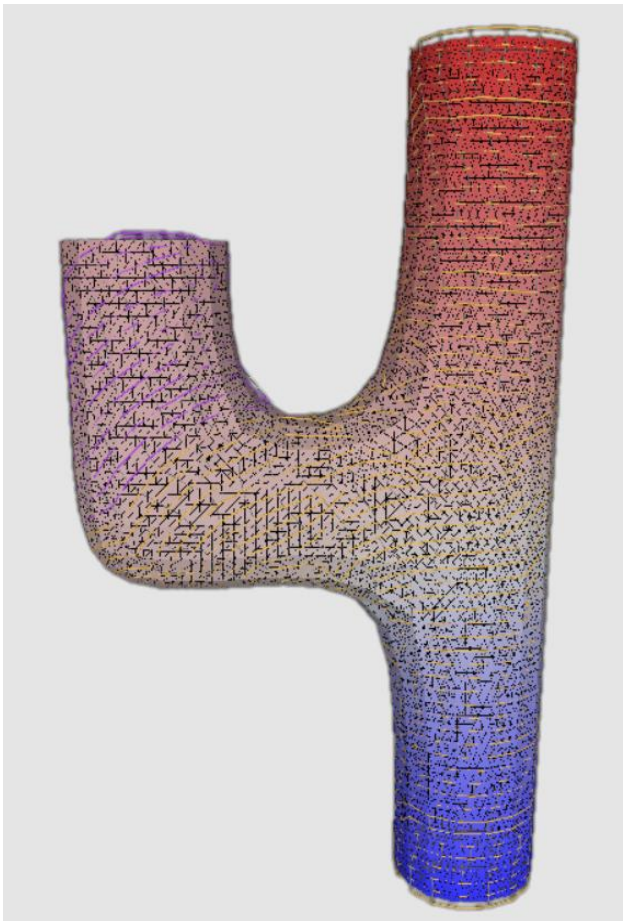
Created constraints for all the boundaries of cactus





2. Peeling/ Linking





3. Scheduling
   Now, the traced stitches have been created, we need to assign them to knitting machine needles. This process is called scheduling. Here, a javascript file is created.

4. Knitout
   Running the javascript file created will create knitout instructions which will be fed to the knitting machine.

7. **Concluding Remarks:**
   We have tested the code for various objects and got their knitnet successfully. This knitnet is then stored in a .st file which is used to create a java(.j) file that consists of instructions to be fed to the machine to perform knitting and get the knitted cloth.

8. **References:**
   https://textiles-lab.github.io/publications/2018-autoknit/
   Citations :
   Nader, Georges, Yu Han Quek, Pei Zhi Chia, Oliver Weeger, and Sai-Kit Yeung. "KnitKit: A flexible system for machine knitting of customizable textiles." ***ACM Transactions on Graphics*** **(2021)**

9. **Declaration:** I declare that no part of this report is copied from other sources. All the references are properly cited in this report.

Signature of the Student

Rajendra Nagar

Signature of the Supervisor

Supervisor's Recommendation for the Evaluation

Please tick any one of the following

1. ✓ The work done is satisfactory, and sufficient time has been spent by the student. The submission by the student should be evaluated in this term.
2. The work is not complete. Continuity Grade should be given to the student. The student would need to be evaluated in the next semester for the same Design Project with me.
3. The work is not satisfactory. There is no need for evaluation. The students should look for another Design Credit Project for the next semester.
4. [Other Comment, if 1-3 are not valid] _____

Rajendra Nagar

Signature of the Supervisor