Hele Shaw Model Instructions

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The following instructions are to create a 3D model of a Hele-Shaw porous media cell that allows two-dimensional fluid flow.

Required Programs:

- Anaconda
- Inkscape
- Fusion 360

Retrieve Python Codes and Fusion 360 Base Model

1. Create a new folder and take note of its location. This folder will be referred to as the Work Folder.
2. Go to https://github.com/Azshian/Hele-Shaw-Model and download these files to the Work Folder.
    a. NetworkSlicer.py
    b. BackgroundRemover.py
    c. FinalCropper.py
    d. Base Model

Download Micro CT Image of Pore Network

1. Go to https://www.imperial.ac.uk/earth-science/research/research-groups/perm/research/pore-scale-modelling/micro-ct-images-and-networks/
2. Click on the file name that you want to extract the network from
3. Click "Download Image (binary and ASCII)"
4. Extract zip file and put the .dat file in the Work Folder
    a. The .raw file is unused

Use Python Script to create a slice from the Pore Network

1. Open Anaconda Prompt
    a. Open Navigator and go to Environments
    b. Left Click Green Arrow next to Anaconda3_64
    c. Click Open Terminal
2. In Terminal, change work directory to the Work Folder by typing:
    a. *cd "<work directory>"*
    b. Example: cd "C:Users\adria\OneDrive\Hele Shaw"
3. Use the NetworkSlicer code to open the .dat file and input parameters of the layer number and the size of the image you want by typing:
    a. *python NetworkSlicer.py <dat file> <layer> <Left_axis> <Right_axis> <Top_axis> <Bottom_axis>*
        i. Layer range from 1 to 299
        ii. Axes range from 0 to 300
            1. Leftmost X axis 0, Rightmost X axis is 300
            2. Uppermost Y axis is 0, Bottommost Y axis is 300
    b. Example: python NetworkSlicer.py LV60A.dat 150 0 300 0 300

        i. This example will yield the full network at layer 150
    c. Example: python SliceCode.py LV60A.dat 150 200 300 200 300
        i. This example will yield a zoomed in network at layer 150
4. The output image will open a new window.
5. To rerun the code to select a different layer and/or zoom in/out to a different location of the network, close the window prior to running the code again.
6. If ready to save desired network, make the window a full screen and press the save icon and save into the Work Folder as a .jpeg file

Image Processing the Slice

1. Use BackgroundRemover.py to open the recently saved.jpeg file and remove the excess pixels such as the axes labels and the white background by typing:
    a. *python BackgroundRemover.py <jpeg file> <save>*
    b. For the save parameter, input 1 to view and save the image as another .jpeg file. The file is automatically placed into the Work Folder.
    c. Input 0 to not save, but still view.
2. The code will output the new image, the pixel width, and the pixel length (height) of the new image. Take note of these values.
3. If the result is as expected, rerun the code to save the file by putting 1 for the save parameter. The new .jpeg file is saved as "FirstCrop.jpeg" in the Work Folder

Cropping the Slice

1. Use FinalCropper.py to open the second saved.jpeg file to crop it into a perfect square network and/or zoom into a specified portion of the network by typing:
    a. python FinalCropper.py FirstCrop.jpeg <Left_axis> <Right_axis> <Top_axis> <Bottom_axis>
    a. If you want to use the full range of either the length or height, make sure you input n-1 for the axis parameter where n is the number that was outputted from the BackgroundRemover.py step
2. The code will output the new image in black and white, the pixel width, and the pixel height. Make sure that the width and height is equal in order to produce a perfect square network.
    a. If you want a rectangular shaped pore network, you will need to edit the Fusion360 base model in later steps.
3. If ready to save desired network, rerun the code to save the file by putting 1 for the save parameter. The final network will be saved to the Work Folder as NetworkSlice.png

Converting Image from Pixels to Vector

1. Open Inkscape

3D Creation

1. Open Fusion360