***When prompted, ensure ‘Y’ is capitalized when wanting to remove items***

**Processing networks in MATLAB using R code for changepoints**

***If running this sequence, ensure there are no preexisting Excel or MATLAB structures with the same name in any of the subfolders (Input/Output/FluidsInput)***

1. First run: Run\_get\_radii\_part1(FILENAME)

Automatically removes double edges, double nodes, and small cycles

Remove Blobs (two questions, Y/N and junction)

Input: input node (node closest to root node, outside of blob)

Output node (node on the other side of blob from input node)

If at junction, give array [node1 node2]

Node in middle (node in blob, djikstra will make the path through this node)

Remove Edges

Input: [node1 node2] (takes array and removes vessel, can be either direction)

Remove Nodes

Input: node (removes node, but does not update vessels if attached)

1. Then run: LocateChangepont.Rmd by changing the names in lines 20 and 21 to the correct network title
2. Run\_get\_radii\_part2(FILENAME, TAPERED VESSELS, SCALE,PLOTON);

FILENAME “control\_MA\_1” (the name of the base .nrrd file)

TAPERED VESSELS = [] (if no vessels are tapered)

TAPERED VESSELS = [ “A”,”B”,…] (if some vessels are tapered list the vessel numbers for vessels that should be tapered)

SCALE (a number), the value of this number can be found in the file “FILENAME”\_SKEL\_dmax\_isthmus1\_p0.nrrd in the line

space directions: (0.742,0,0) (0,0.742,0) (0,0,0.742)

Note: SGEXT assumes that the .nrrd is isotropic, i.e., that the x,y,z scaling are the same. In the example above SCALE = 0.742

PLOTON = 1 (Graphs will appear showing the radii along each vessel)

PLOTON= 0 (No graphs will appear)

**Processing networks entirely in MATLAB**

***If running this process, please ensure necessary subfolders (Networks/FluidsInput/Output) have been created. The specific subfolder corresponds to the variables wanting to save from the Workspace***

1. Run: Run\_get\_radii(FILENAME,TAPERED VESSELS, SCALE,PLOTON)

FILENAME “control\_MA\_1” (the name of the base .nrrd file)

TAPERED VESSELS = [] (if no vessels are tapered)

TAPERED VESSELS = [ “A”,”B”,…] (if some vessels are tapered list the vessel numbers for vessels that should be tapered)

SCALE (a number), the value of this number can be found in the file “FILENAME”\_SKEL\_dmax\_isthmus1\_p0.nrrd in the line

space directions: (0.742,0,0) (0,0.742,0) (0,0,0.742)

Note: SGEXT assumes that the .nrrd is isotropic, i.e., that the x,y,z scaling are the same. In the example above SCALE = 0.742

PLOTON = 1 (Graphs will appear showing the radii along each vessel)

PLOTON= 0 (No graphs will appear)

Automatically removes double edges, double nodes, and small cycles

Remove Blobs (two questions, Y/N and junction)

Input: input node (node closest to root node, outside of blob)

Output node (node on the other side of blob from input node)

If at junction, give array [node1 node2]

Node in middle (node in blob, djikstra will make the path through this node)

Remove Edges

Input: [node1 node2] (takes array and removes vessel, can be either direction)

Remove Nodes

Input: node (removes node, but does not update vessels if attached)

**Outputs of Code** *(Comment out whatever you do not want saved)*

FluidsInput – Saves only the Data structure created by CreateFluidsCodeInput.m, is the input if running the fluids simulations

Output – labeled ‘Vessels\_’ saves the entire workspace at the end of the code, allows you to view what’s created by code

Networks – Saves specifically 'arcsC3', 'nodesC2', 'Data','vessel\_details', 'TaperVes','ploton','Scale','maxDaughters', used in justChangepoints.m to save time and to extract statistics

**Variables Created in Behind the Scenes**

**path:** A list of nodes transversed to get to any node in the network starting at the root node. From these paths we can see if the network has not been corrected appropriately.

**nodes**: a [N x 5] matrix containing information about the vertices (also called 'nodes') in the network. It is formatted as: [node ID | x | y | z | degree of node].

**arcs**: [1 x n] cell structure. Each cell in arcs is a [m x 4] matrix containing data for an individual edge in the network. The first row of the arcs matrix is [ node1 ID | node2 ID | 0 | 0 ] (with the zeros just being placeholders). Subsequent rows in the arcs matrix are formatted as [ x | y | z | rad], containing the coordinates of points along that edge and the vessel radius at those points.

**Orientation:** This code assigns a -1 to all vessels that are oriented the wrong way.



**newNetwork:** is a matrix with 6 columns stating 1: Vessel ID, 2: ID for starting node, 3: ID for end node, 4: IQM of the vessel radius, 5: Vessel length, 6: std of the vessel radius.

**connectivity:** first column start node, 2nd column in-degree – how many daughters, 3rd column out-degree – how many parents, columns 4-7 ID for daughter vessels, columns 8-9 ID for parent vessel.

**maxDaughters:** Max number of daughters

**maxParents:** Max number of parents

**vesselDetails:** [1x9] cell structure. Each cells is [vx1] matrix containing data about each vessels. 1st cell – VES ID, 2nd cell – CL File, 3rd cell – Length [mm], 4th cell – Mean Radii [mm], 5th cell – Median Radii, 6th cell – Radii Standard Deviation, 7th cell - Parent ID, 8th cell – # of Daughters, 9th cell – Daughters ID