Suppose that the shape of the network formed by the Physarum is represented by a graph, in which a plasmodial tube refers to an edge of the graph, and a junction between tubes refers to a node. Two special nodes labeled as 𝑁1 and 𝑁2 act as the starting node and ending node, respectively. The other nodes are labeled as 𝑁3, 𝑁4, 𝑁5, 𝑁6, and so forth. The edge between node 𝑁i and 𝑁j is expressed as 𝑀ij. The parameter 𝑄ij denotes the flux through tube 𝑀ij from node 𝑁i to𝑁j.

Q is the flux, which is the flow of nutrients through the tube. D is the conductivity, essentially the thickness of the tube. M is just a name for the tube, not a number. L is length, pretty straight forward for the shortest path problem.

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Kirkoff’s current law

A picture containing background pattern

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All flux’s going into the source node (i 🡪 1) will ad up to the total flux I0. Since it is flowing *into* the source, the total flux will be negative. Similarly, all flux’s flowing into the sink (i 🡪 2) will also add up to the total flux, but positive.

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This is the system of equations that needs to be solved. Our equation may have a similar structure, but it will not be the same since this is focused on shortest path.

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Energy in is a function of nutrient flux. Energy out is a function of the width of the tube, Next iteration’s width is a function of the net energy.

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The change in tube width to be applied to the next iteration.

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They combined their equations and got this iterative equation

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Ok so here’s the thing, I don’t want to tell the mol where the nodes should be in between the two lines, so I’m not sure nodes is the right move.

So we have kinda 2 nodes like the above problem, a start and an end. The start is the top line that applies the stress along it. The total stress (integral under the stress function) is equal to 1. This is the same as the pressure. The pressure of the bottom line is 0 everywhere. Side note: it could be interesting to see if there is a function at the bottom, like a bridge only supported at the edges.

We want nodes in the middle, but we do not want to tell it where, so that may be where this breaks down.

Starting position: should it be a completely filled in thing, nothing there, pillars, crosses….who knows…probably nothing?

Or maybe there could just be a ton of nodes. The only problem would be that this would take way too long to solve.

We could give it a single pillar in the middle, then randomly add branches with thin tubes from a random height on the pillar to a random spot on to the top or bottom line. Then we would need to optimize that new shape and compare it to the original. Then add more branches, optimize, and compare in a loop. That could take a while, but it may work?

The only thing is that if the new branches don’t share a node, there won’t be any force on that new member. Ok, so instead it splits and the old member no longer exists. Dope!