ICSolar Model

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1 Heat Conduction

1.1 Through the Tube

For the pipe filled with water, we have

$$R_{total} = R_{conv,water} + R_{cyl,tube} + R_{cyl,ins} + R_{conv,air}$$

$$R_{total} = \frac{1}{2\pi r_{inner} L h_{water}} + \frac{\ln r_{tube}/r_{inner}}{2\pi L k_{tube}} + \frac{\ln r_{ins}/r_{tube}}{2\pi L k_{ins}} + \frac{1}{2\pi r_{ins} L h_{air}}$$

and

$$\dot{Q} = \frac{T_{water} - T_{air}}{R_{total}}$$

In your python code, you have

```
R.R_cond_t = math.log((diameter_tubing)/(diameter_inside)) /
                (2 * math.pi * diameter_tubing * tubing_length * cond_tubing)
R.R_cond_ins = math.log((diameter_insulation)/(diameter_tubing)) /
                (2.0 * math.pi * diameter_insulation * tubing_length * cond_insulation)
```

Which I believe have an extra diameter in the denominator, which is why both your matlab code and your python script give the different answer. Unless my theory is wrong, which it might be, but I have a copy of the thermodynamics book in front of me. My code does have errors in the fluxes, but theres a reason mine doesnt seem to do much, and its the differing of this large number.

1.2 Across a Plate

We have

$$R_{total} = \frac{1}{h_{air} A} + \frac{t_{plate}}{k_{plate} A} + \frac{1}{h_{interior} A}$$

where t_{plate} is the thickness of the glass, and A is the surface area. Similarly,

$$\dot{Q} = \frac{T_{\text{outsideofplate}} - T_{air}}{R_{total}}$$

This is correct in your code.