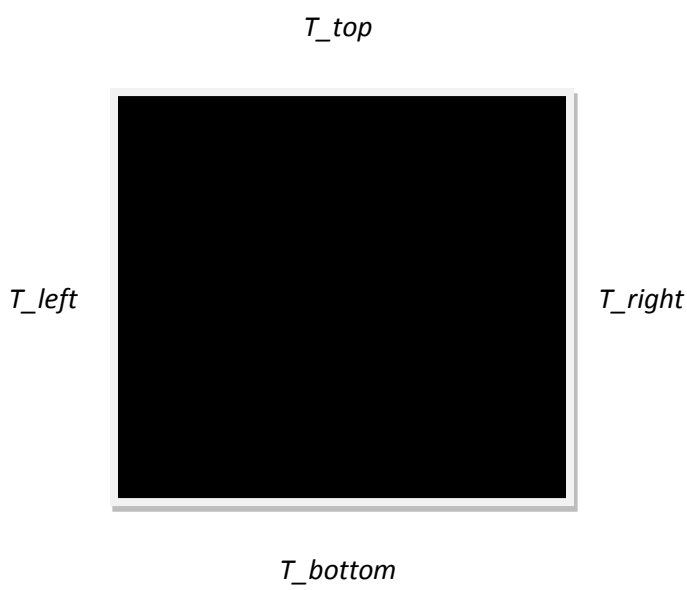
Flat Plate Conduction SolidWorks Tutorial

Problem Statement: This problem assumes constant temperatures (T_top, T_bottom, T_left, T_right) on the appropriate edges of a flat plate. This problem assumes only conductive behavior through the plate (i.e. there are no effects due to convection from the surrounding air). The thickness of the plate doesn't matter because the constant temperatures are applied across the entire respective surfaces. This problem can be verified with an attached MATLAB model that uses a successive over-relaxation method to calculate constant temperature profiles. It should also be noted that this problem only takes equilibrium profiles into account (i.e. SolidWorks provides the equilibrium temperature profile, as does the successive over-relaxation method).



1. Draw a flat plat and specify the material of the plate (I used AISI 1020 Steel). I used square dimensions to preserve symmetry for the validation process of the experiment.

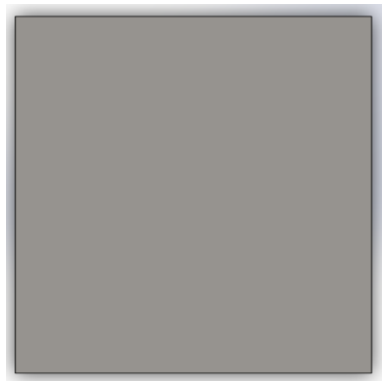


Figure 1: Flat plate constructed in SolidWorks.

2. Select the SolidWorks “Office Products” tab and click on “SolidWorks Simulation”. A new tab labeled “Simulation” will be created. Select the “Simulation” tab, click on “Study Advisor” and select “New Study”.

Figure 2: “Office Products” tab and “SolidWorks Simulation” Icon. “Study Advisor” icon.

3. A new study will appear in the property manager on the left side of the screen. Select the “thermal” study. Select “ok” to return to the model.

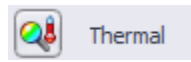


Figure 3: “Thermal” study icon.

4. Use the “thermal loads” icon in the simulation tab to specify heat transfer conditions. Select “temperature” from the drop-down menu to apply a temperature on a given surface of the flat plate. Apply a hot temperature on the bottom edge of the plate and a cold temperature on the other three edges (using the temperature icon in consecutive applications of edge temperatures).

Figure 4: “Thermal Loads” icon.

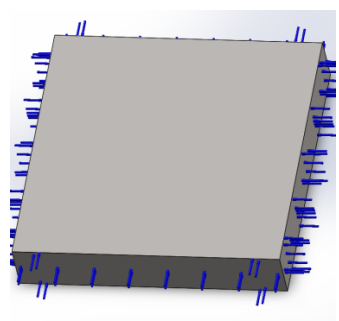


Figure 5: Flat plate with temperature load applied on edges.

5. Select “run” and observe the constant temperature profiles provided by the SolidWorks simulation. Note that by right clicking on the results tab on the left side of the screen, different plots can be constructed.

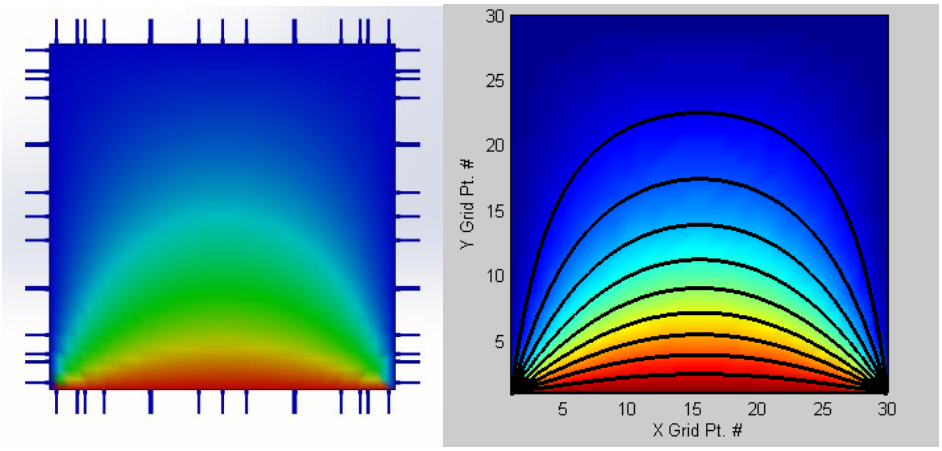


Figure 6: SolidWorks (left) vs. MATLAB Code with 500[K] temp on bottom.

6. Use the provided MATLAB code and verify the results (you can verify by probing at a given point and matching to the corresponding matrix point or you can verify visually).
7. Change one of the edge temperatures and observe the results. I changed the left edge to 1000[K] and left the other edges the same.

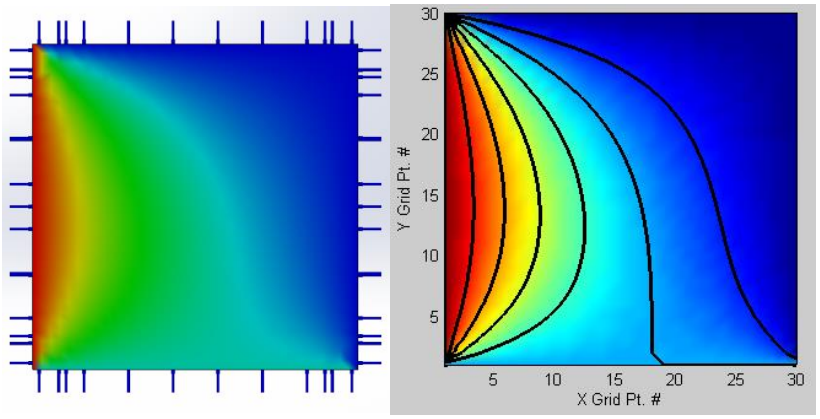


Figure 7: SolidWorks (left) vs. MATLAB code with 1000[K] temp on the left side, 500[K] temp on the bottom, and cold temp applied to the other surfaces.