

Slide 1:

Nicolaj:

Hi. My name is Nicolaj, and this → is Petter.

For our project we have chosen to apply the heat equation on a heat sink. A heat sink is a heat exchanger with the purpose of transferring heat generated by a mechanical or electronic device. It is commonly used in computers to cool down the CPU or GPU together with a fan. (Point to picture)

Slide 2:

Petter:

We've chosen to look at four different geometries. As you can see there are two with four fins and two with eight, where the two on the bottom are twice the height of the top on the top. The surface of number two and number three are the same. → @ picture
Because of this we should be able to compare the heat flux between the two.

Slide 3:

Nicolaj:

For the boundary conditions we have constant Dirichlet boundary conditions of 80 degrees Celsius on the bottom of the heat sink, and for the rest of the boundary we actually have Robin boundary condition because the heat flux from the surface of the heat sink to the surrounding air is dependent on the temperature of the surface itself.

Slide 4:

Nicolaj:

You can see what I'm talking in this equation up in here.

- Stationary
- Poisson
- Conductivity constant (material dependent)
- Heat transfer coefficient (material dependent)
- Minus sign

Slide 5:

- This particular problem was not in the book.
 - Had to derive it ourselves
- Calculations weren't very complicated, but it was rewarding having to feel like we had to come up with something on our own.
- Had to trust our calculations when debugging the code.
- The only volume integral is constant
 - Our quadrature3D code was off with about 5 %, when we compared with known solutions.

Slide 6:

- The same geometries as on the previous slides.
- Cutting planes through the middle.
- Can't see the temperatures, but the two on the top ranges from 60 to 80, the bottom 40 to 80.
- Somewhat surprised when the temperature on the two on the top were the same
 - Makes sense since the Dirichlet boundary is an infinite heat source.

- The two have the same volume and same surface area.
- The heat flows out to the surroundings as it travels upward the fins.
 - The higher points will be less effective.
- Flux is dependent on the temperature difference, so the one with many short fins will have a greater heat loss to the surroundings.
 - Making it more effective
 - This is our conclusion
- We could calculate this if we wanted, but we haven't done that.
- Instead use this temperature argument for why many short, thin fins are better, in order to maximize the surface area.
- That being said when the fins get closer together, there may be other phenomena coming into play:
 - Heat transfer between the fins.
 - Too little air, so the constant ambient temperature assumption no longer holds.
- Our model doesn't take this into account.