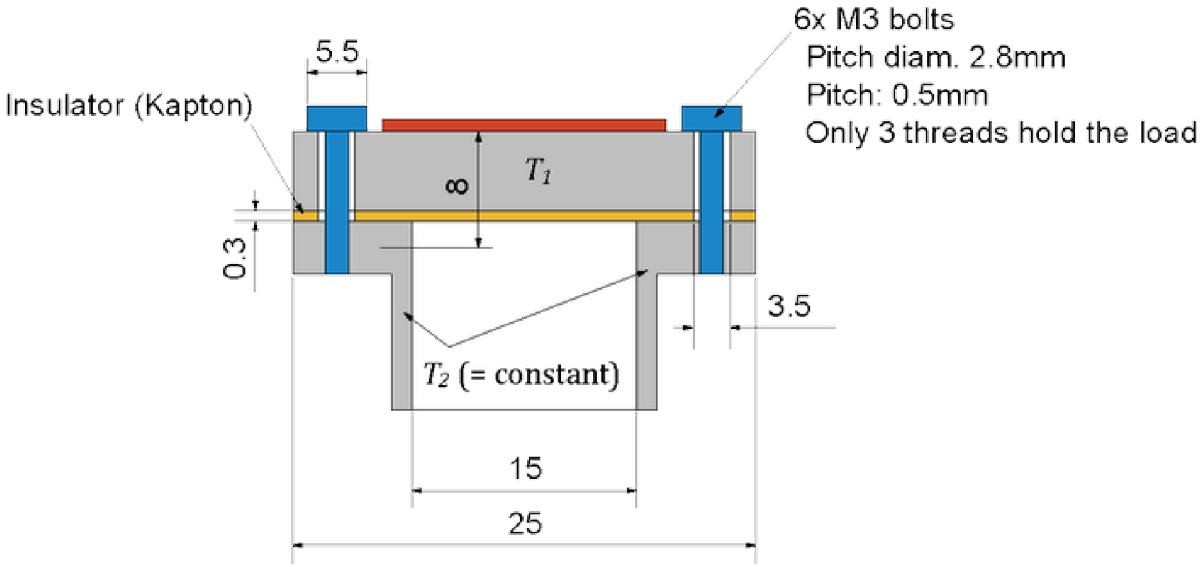
EE-580 Space Mechanisms

Exercise 4.3 - Thermal Conductivity

v.01

Problem Statement

A heated aluminum flange is fixed to a constant temperature aluminum structure with 6 M3x8 stainless steel bolts. A 0.3 mm thickness Kapton insulator sheet thermally disconnect the two parts.



Numerical data

Thermal conductivities:
Stainless steel: 16 W/(m·K)
Kapton: 0.12 W/(m·K)
Thermal conductance of the contact: 10^7 W/(m ^{2}·K) Note: Kapton-metal and metal-metal are considered to be identical
Temperatures of the structures [°C]:

In[ ]:=
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T1 = 70;
T2 = 55;
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Hint: the bolts have a simplified geometry, i.e. the threads have a perfectly rectangular shape, with a contact on the whole length.

Questions

- What is the thermal power transferred from the flange to the structure?
- Which part has the highest contribution: the bolts or the direct conduction through the structure?

Solution