Thermal Contact Conductance

Thermal Conductivity in Heat Transfer – Lesson 3

Ansys

Introduction to Contact

In the physical world, bodies interact through contact.

- Contact forces prevent bodies from penetrating.
- In simulation, properly considered contact behavior is crucial for predicting the correct system response.

Contact exerts a force from the bat to the baseball to change its direction.

Contact provides support to the skier, so she does not sink into the snow.

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Thermal Contact

Contact not only transfers forces, it can also exchange energy through heat: This is known as **thermal contact**.

- Thermal contact is necessary for two bodies to transfer heat through conduction.

Thermal contact transfers heat from the heating coil to the pot.

Thermal contact transfers heat from the iron to the cloth.

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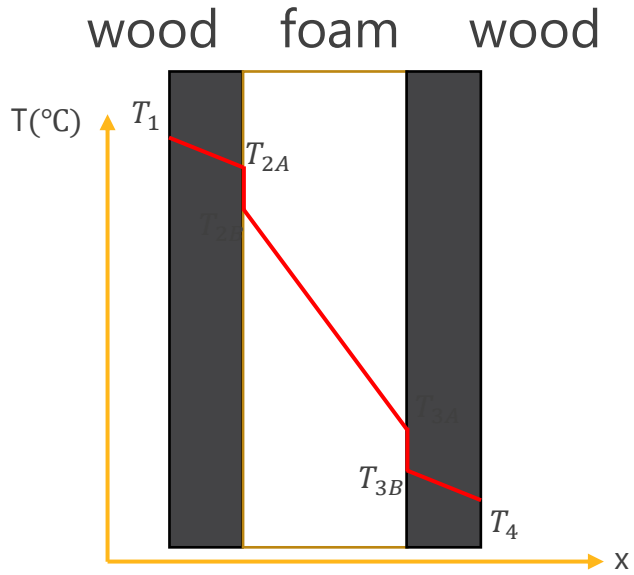
Thermal Contact Conductance

The Thermal contact conductance coefficient h_c, with unit, $\left(\frac{W}{Km^2}\right)$, is used to quantify a contact's ability to conduct heat.

- The inverse of thermal contact conductance is thermal contact resistance.

Contact between the composite wall layers create thermal contact resistance.



Thermal contact resistance causes the temperature drop at the interface.

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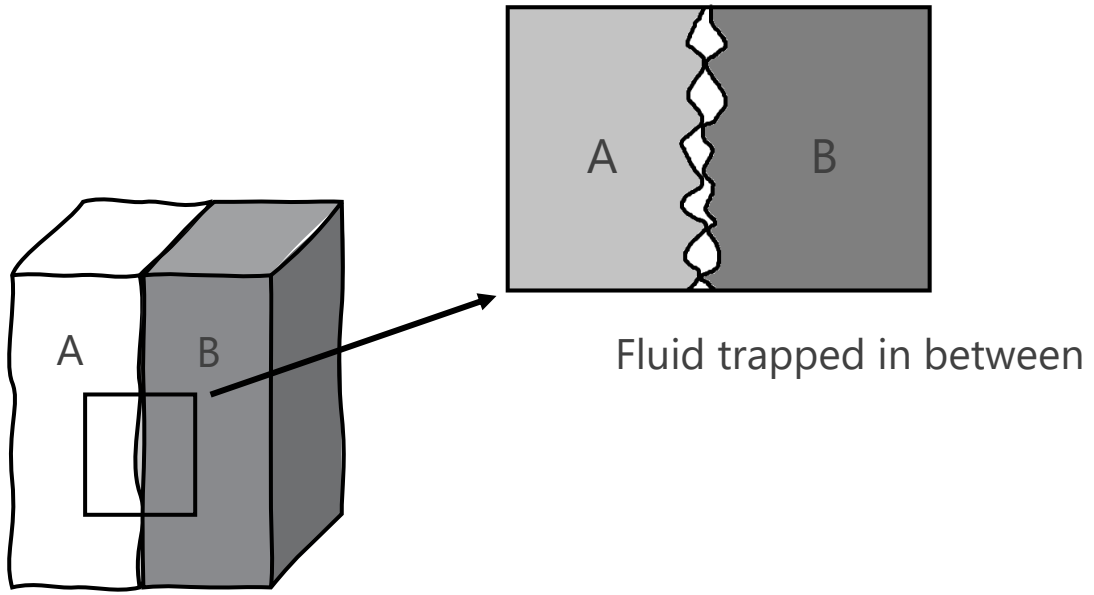
Thermal Contact Conductance

There are many factors influencing thermal contact conductance: contact pressure, surface roughness, the interface fluid and the interface temperature.



Contact pressure and surface roughness influence the amount of fluid (air or liquid) trapped in the interface, and directly influences the thermal contact conductance.

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Thermal Contact Conductance

Whether thermal contact conductance is significant or not depends on its ratio to the thermal conductivity of the base material:

- For good conductors like copper and steel, thermal contact conductance can play an important role.
- For insulators like foam, the effect of thermal contact conductance is less important.

A summary of thermal contact conductance is shown below:

Material	**Temp (℃)**	**Pressure(MPa)**	**Conductance ($W/K/m^2$)**
Stainless steel – Stainless steel	90-200	0.3-2.5	3800
Aluminum – Aluminum	150	1.2-2.5	11,400
Copper – Copper	20	1.2-20	143,000
Aluminum – Copper	20	15	56,000
Stainless steel – Aluminum	20	20	3600

Reference: https://www.engineersedge.com/heat_transfer/thermal_contact_conductance_13849.htm

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