Flexible PCB set up in Flotherm XT

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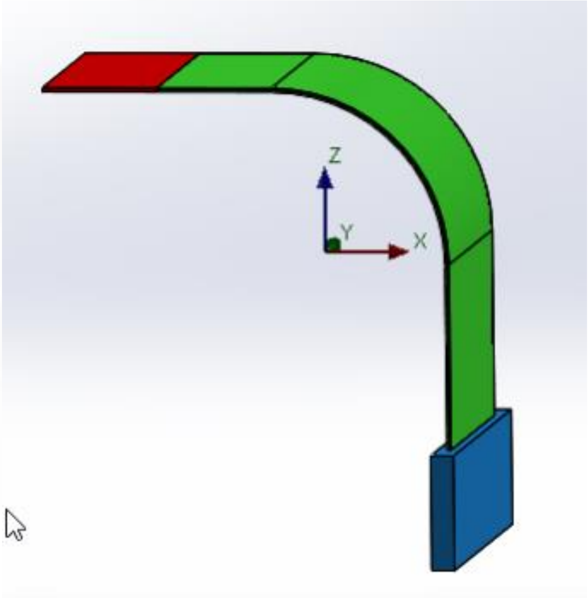
Introduction

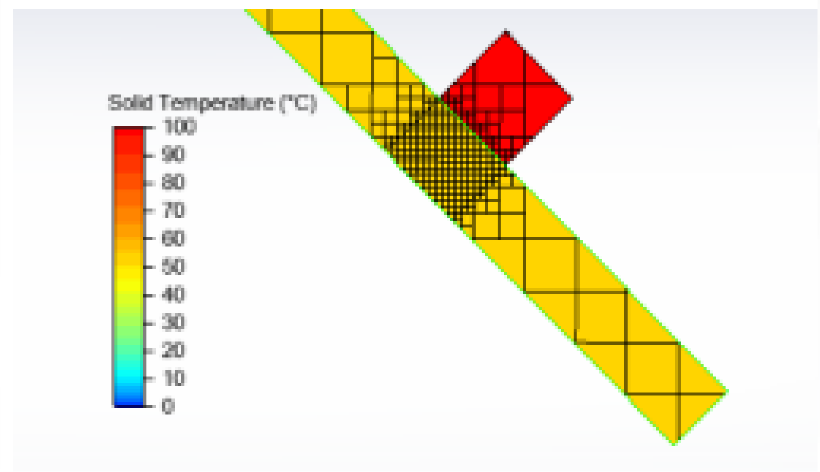
- FPCB(Flexible PCB)為軟性電路板，會有局部彎曲的結構
- FPCB(Flexible PCB)進行建模的設定，方法基於PCB內Isotropic material property與In-plane thermal conductivity的定義內部熱傳率，透過接觸熱阻於PCB表面去定義In-plane conductivity，該方法用較少的網格量，即可定義詳細的PCB特性。



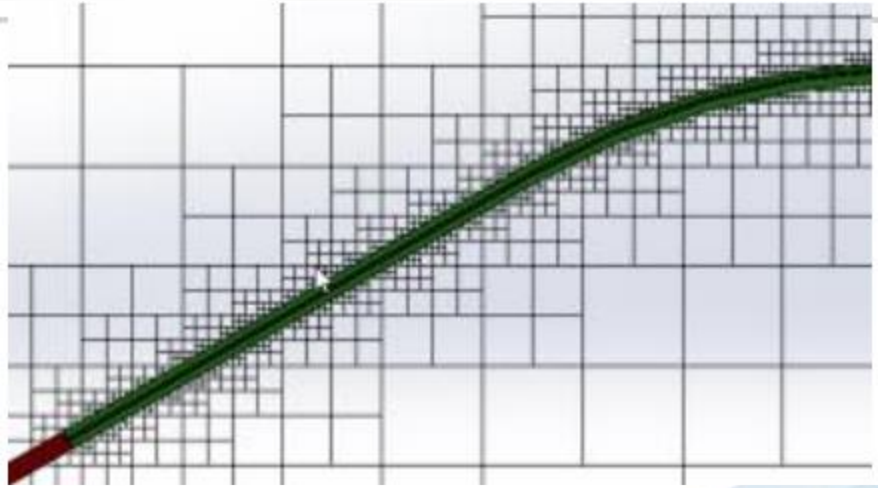
軟性電路板(FPCB)

Example

- FPCB如搭配雙軸材料(Biaxial)設定，因雙軸材料設定是參照座標軸，在設定材料方向性會有落差，透過平面熱傳搭配接觸熱阻，可有效避免此問題



斜板PCB

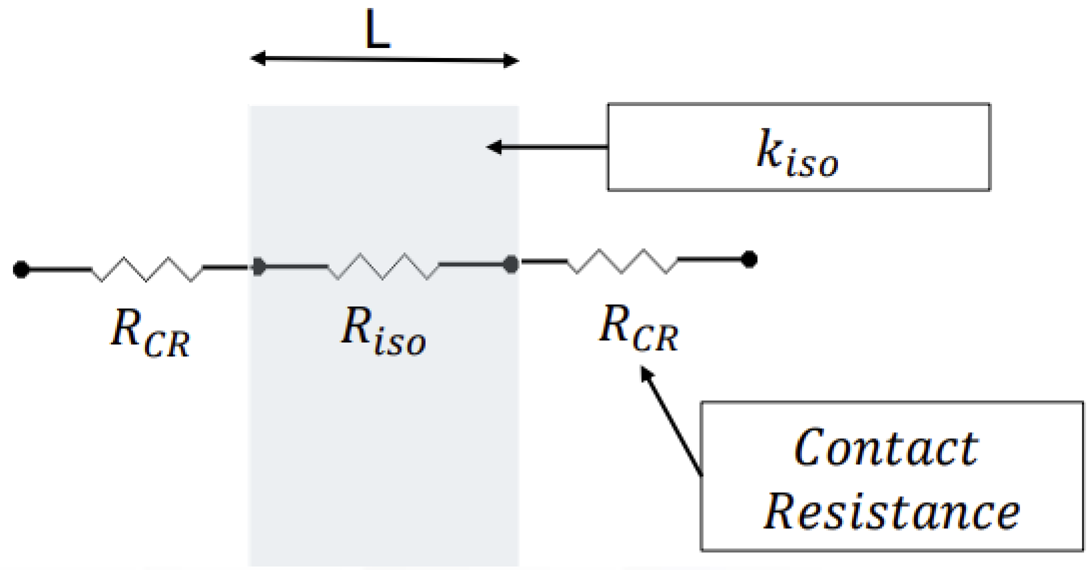


FPCB

Recommended method for modeling FPCB

- 垂直方向熱傳較差，因此利用2個$R_{CR}+R_{ISO}$取代R_{Axial}
- 水平方向熱傳維持不變

Isotropic/Contact Resistance Model



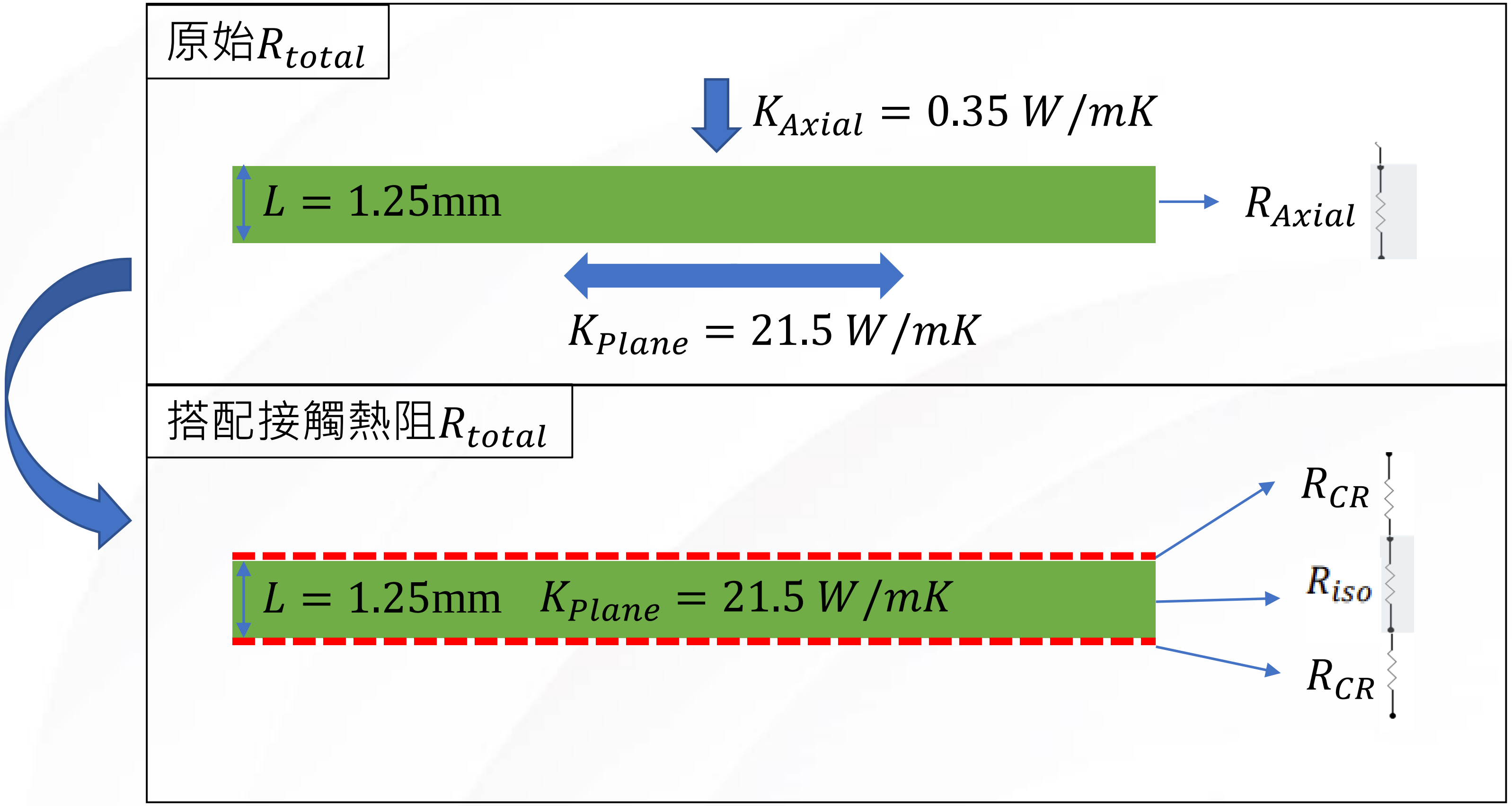
L= thickness of the board.

$$R_{Axial} = R_{CR} + R_{iso} + R_{CR}$$

$$\frac{L}{K_{Axial}} = (2 * R_{CR}) + \frac{L}{k_{iso}}$$

$$R_{CR} = \frac{L}{2} * \left(\frac{1}{k_{biaxial\_thru}} - \frac{1}{k_{iso}}\right)$$

Contact Resistance Calculation



R_{Axial}=0.00357(K·m^2)/W

$$R_{Axial} = \text{L}/\ K_{Axial}$$

利用R_{CR}取代K_{Axial}垂直方向較低的熱傳

$$R_{total} = R_{CR} + R_{iso} + R_{CR}$$

$$R_{CR} = \frac{L}{2} * \left(\frac{1}{K_{Axial}} - \frac{1}{K_{plane}}\right)$$

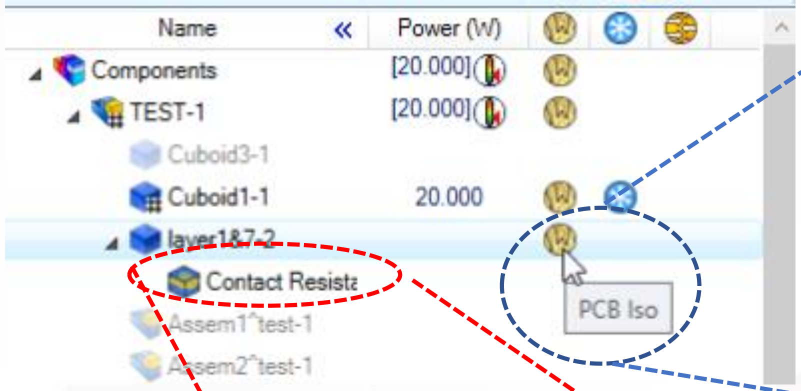
$$R_{iso} = \text{L}/\ K_{plane}$$

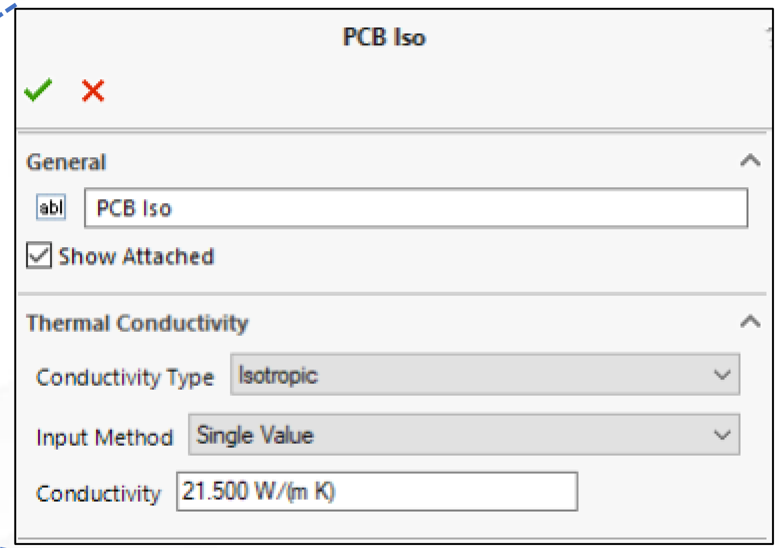
$$R_{Axial} = \frac{0.00125}{2} * \left(\frac{1}{0.35} - \frac{1}{21.5}\right) + \frac{0.00125}{21.5} + \frac{0.00125}{2} * \left(\frac{1}{0.35} - \frac{1}{21.5}\right)$$

$$R_{Axial} = 0.00175 + 0.0000581 + 0.00175$$

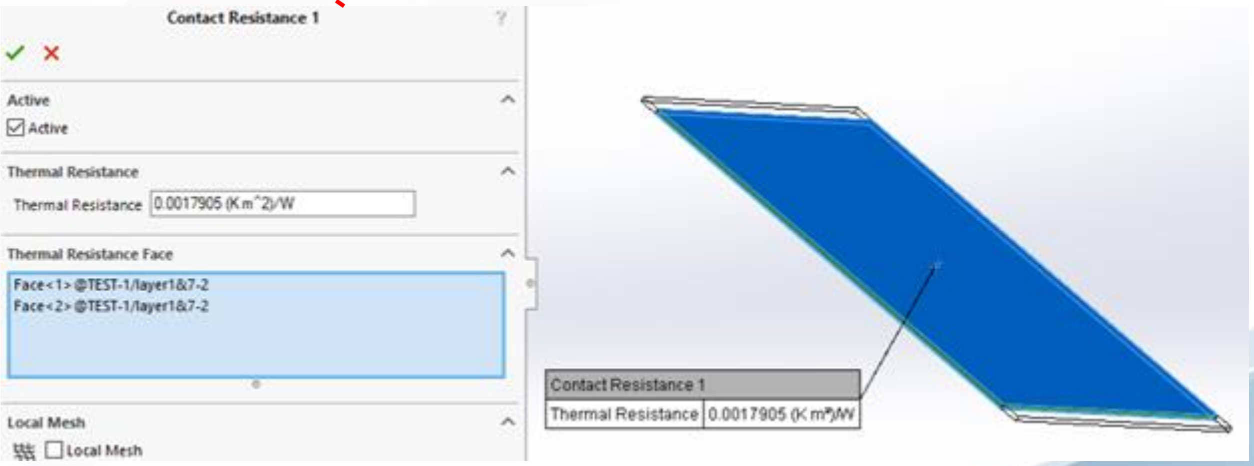
R_{Axial}=0.00357(K·m^2)/W

XT PCB Set up



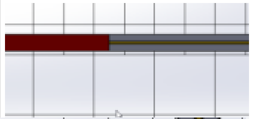
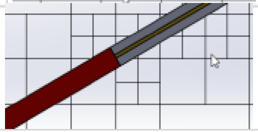


右圖為K_{Plane}的熱傳率

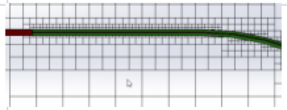
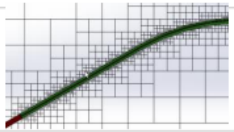


在表面設定接觸熱阻 R_{CR}
上下表面都須設定

Result

		Straight Board Assy		
	Mesh Image	Detailed Model - 3 Layer	Biaxial Board Assy	Iso with Contact Resistance Board Assy
		(21.5 W/m*K, .35 W/m*K)	(21.5 W/m*K, .35 W/m*K)	(21.5 W/m*K)
Aligned		173.4	171.0	170.9
Non-Aligned		172.2	171.4	170.8

- 斜板的三種材料設定差異較小
(Detailed vs Biaxial vs Iso with Contact Resistance)

		Bent Board Assy		
	Mesh Image	Detailed Model - 3 Layer	Biaxial Board Assy	Iso with Contact Resistance Board Assy
		(21.5 W/m*K, .35 W/m*K)	(21.5 W/m*K, .35 W/m*K)	(21.5 W/m*K)
Aligned		172.2	216.6	172.2
Non-Aligned		173.2	216.6	172.7

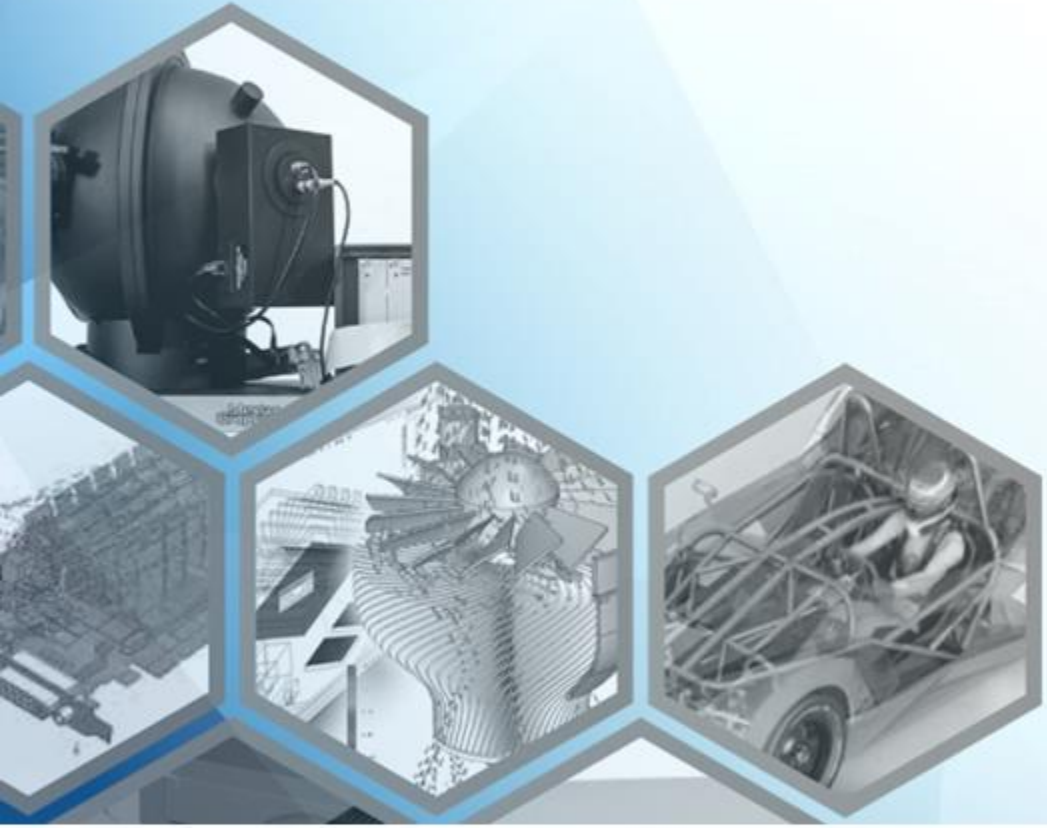
- FPCB的設定，雙軸材料(Biaxial)的設定結果誤差最大
- Isotropic Material 搭配接觸熱阻與Detail model結果較為接近

Conclusion

- 針對FPCB，使用Isotropic Material 搭配接觸熱阻可有效描述PCB特性
- Isotropic Material 搭配接觸熱阻，可不受限於任何複雜曲面PCB
- 使用 Flotherm XT EDA Bridge 創建一個Detail model (layered) ，可同時描述正交或是斜板PCB模型，但需耗費較多網格量，若能使用Isotropic Material 搭配接觸熱阻，不需要大量網格，即可解析PCB傳熱特性

Thanks

謝 謝



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