Consider that a designer wants to design a device to control temperature. One of the solutions is to use a linear bimetallic thermostat composed of two strips made of two different metal alloys denoted by A and B, as illustrated in Fig. 7.

<Figure 7. A linear bimetallic thermostat.>

At initial condition (at temperature T0) the un-deformed length of A and B is *L*, width is *W*, and the thicknesses are *SA* and *SB*, respectively. The coefficient of thermal expansion and modulus of elasticity of A and B are *σA* and *σB*, and *EA* and *EB*, respectively. If the thermostat is exposed to a temperature difference *ΔT*=(T-T0), A and B elongate by a length *LσAΔT* and *LσBΔT*, respectively and the difference in the elongation (*L*(*σA*-*σB*)*ΔT*) forces it to bend to a radius of curvature ρ. As a result, a deflection *d* (see Fig. 7) occurs. This deflection is used to operate an on-off mechanism to control the energy flow and, thereby, to control the temperature. Stephenson et al. [34] provide an analysis of bimetallic thermostat shown in Fig. 7. From such an analysis, the Analytical Knowledge (AK) can be constructed. For this particular case, AK consists of three expressions F1, F2, and F3. These expressions are described as follows:

From the viewpoint of geometry, the radius of curvature (*ρ*) is related to un-deformed length (*L*) and deflection (*d*) in the following manner

 (3)

The deflection (*d*) is usually kept very small (around 10% (or so) of the un-deformed length). Therefore, the ratio of *d* and L (β) is an important design issue. This produces the following relationship:

 (4)

On the other hand, from the viewpoint of mechanics of material, *ρ* can be expressed as a function of modulus of elasticity, co-efficient of thermal expansion, thickness of A and B assuming that both A and B have rectangular cross-sections:

 (5)

In (5), *n* = *EA*/*EB*, *m* = *SA*/*SB*, Δ*T*=T-T0.

 (6)