EXAMPLE 2.8-1: Resistance of a Bracket

You may be faced with trying to understand the heat transfer through a complex, 2-D or 3-D geometry, such as the bracket illustrated in Figure 1. It is beyond the scope of any technique discussed in this book to analytically determine the heat flow through this geometry and therefore it will be necessary to use a finite element software package for this purpose. However, it is possible to use the resistance concept to bound and estimate the heat flow through the bracket. Doing so is a useful exercise for several reasons. If you determine that the heat flow cannot possibly be important to the larger application (whatever that is) then the time and money required to generate the finite element model can be saved. If a finite element model is generated, then the simple thermal resistance estimate can provide a sanity check on the results.

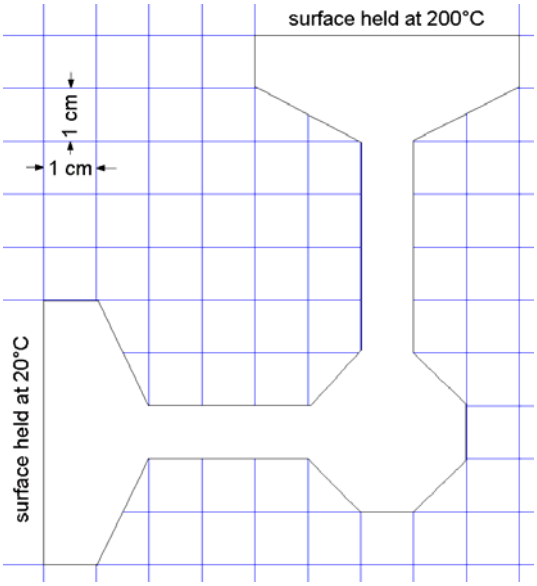

Figure 1: A bracket with a complex, 2-D geometry made of steel with k = 14 W/m-K and thickness 1 cm (into the page).

The bracket is made of steel having a thermal conductivity k = 14 W/m-K. One surface of the bracket is held at T_H = 200°C and the other is at T_C = 20°C.

a.) Estimate the rate of heat transfer through the bracket using a resistance approximation.
b.) Use FEHT to determine the rate of heat transfer through the bracket.