

# Heat transfer course project

## Case #1

A truck cartage that has a top surface of length ( $L$ ) 8m and width ( $W$ ) 2.5m, is travelling on the highway. The top surface of the cartage is subjected to  $1000 \text{ W/m}^2$  solar radiation and the surface absorptivity is 20%. The ambient air is  $20^\circ\text{C}$  and the radiation from the cartage top surface is neglected (heat transferred from the surface is assumed to be only by convection to ambient air). **Using COMSOL, ANSYS or any other numerical software to find the following:**

- (1) The effect of truck velocity from 20 to 140 km/h (use step of 20 km/h) on the local surface temperature (Plot  $T_s$  Vs.  $x$  for different velocities).
- (2) The effect of truck velocity from 20 to 140 km/h (use step of 20 km/h) on the cartage top surface average temperature and overall convection coefficient (Plot  $T_{s, avg}$  and  $h_{avg}$  Vs.  $U$  on the same graph).
- (3) The effect of truck velocity from 20 to 140 km/h (use step of 20 km/h) on the friction force on the top surface and overall skin friction coefficient (Plot  $F_f$  and  $C_{f, avg}$  Vs.  $U$  on the same graph).
- (4) Compare the numerical results of (1), (2) and (3) with manual solution from empirical equations in your correlations book (you can use MATLAB, EES, EXCEL or calculate them manually).

### **Note:**

- You must perform a mesh independence study using **at least 3 mesh levels** to select the suitable mesh for your simulation.

### **Instructions:**

1. The project is performed in groups of 8 to 10 members.
3. A detailed report must be submitted containing the required results and graphs.