12. Case Study: Using EES in Electronics Cooling

What is EES?

EES (pronounced 'ease') stands for Engineering Equation Solver. The basic function provided by EES is the solution of a set of algebraic equations. EES can solve differential equations, equations with complex variables, do optimization, provide linear and non-linear regression and generate plots.

There are two major differences between EES and existing numerical equation-solving programs. First, EES automatically identifies and groups equations that must be solved simultaneously. This feature simplifies the process the user and ensures that the solver will always operate at optimum efficiency.
Second. EES provides many built-in mathematical and thermophysical property functions useful for engineering calculations. So that we can use EES for solving many electronics cooling problems

EES Features List

- Flexible for any engineer to use it
- Solves up to 6000 simultaneous non-linear equations
- Extremely fast computational speed
- SI and English units
- Parametric studies with spreadsheet-like table
- Single and multi-variable optimization capability
- Multi-dimensional optimization
- Uncertainty analysis
- Linear and non-linear regression
- Professional plotting (2-D, contour, and 3-D) with automatic updating
- Graphical user input/output capabilities with Diagram window

EES Applications in Electronics Cooling Problems

Problem 1:

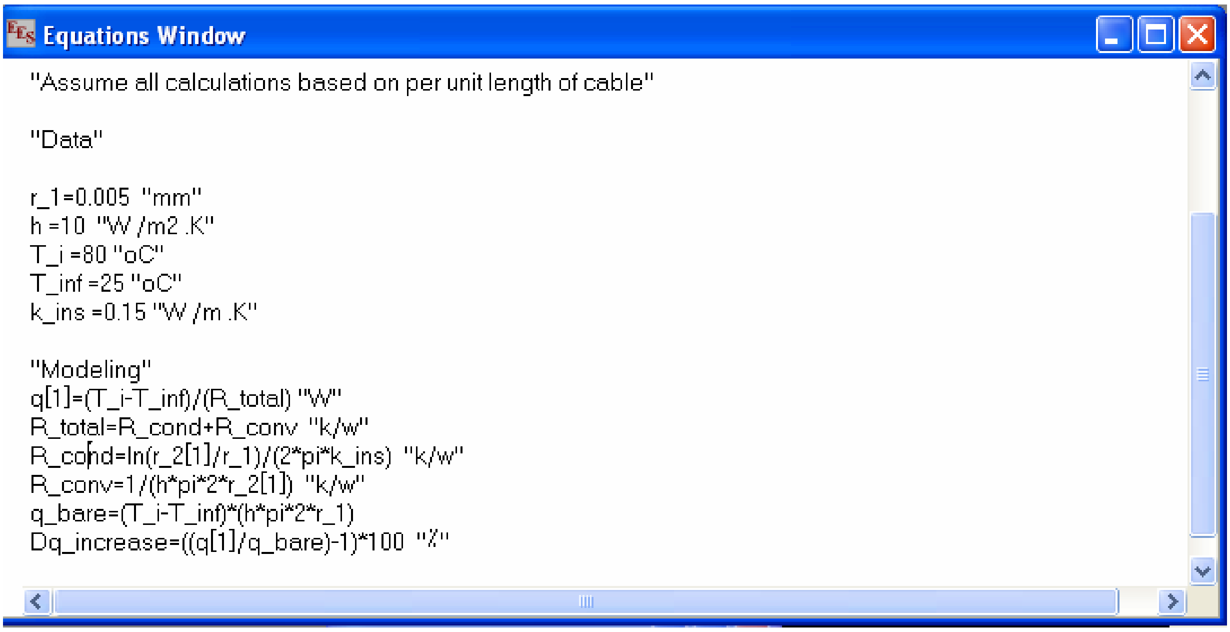
A cable 10 mm diameter at 80 ^{o}C surface temperature is to be insulated to maximize its current carrying capacity. The heat transfer coefficient for the outer surface is estimated to be 10 W /m^{2} .K. and 25 ^{o}C outside air temperature.

What should be the radius of the chosen insulation at 0.15 W /m .K. insulation thermal conductivity? By what percentage would the insulation increase the energy carrying capacity of the bare cable?

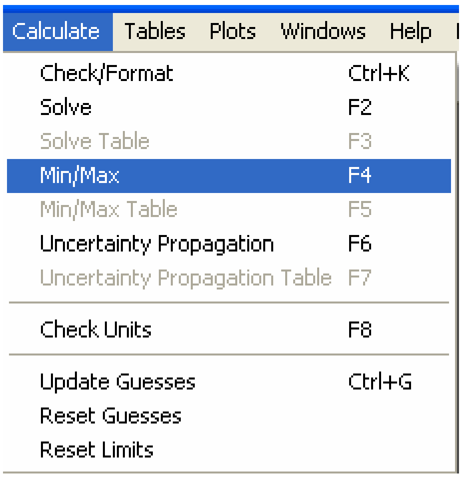
Objective: (1) modeling any problems (2) Optimization (3) Plot results

Solution:

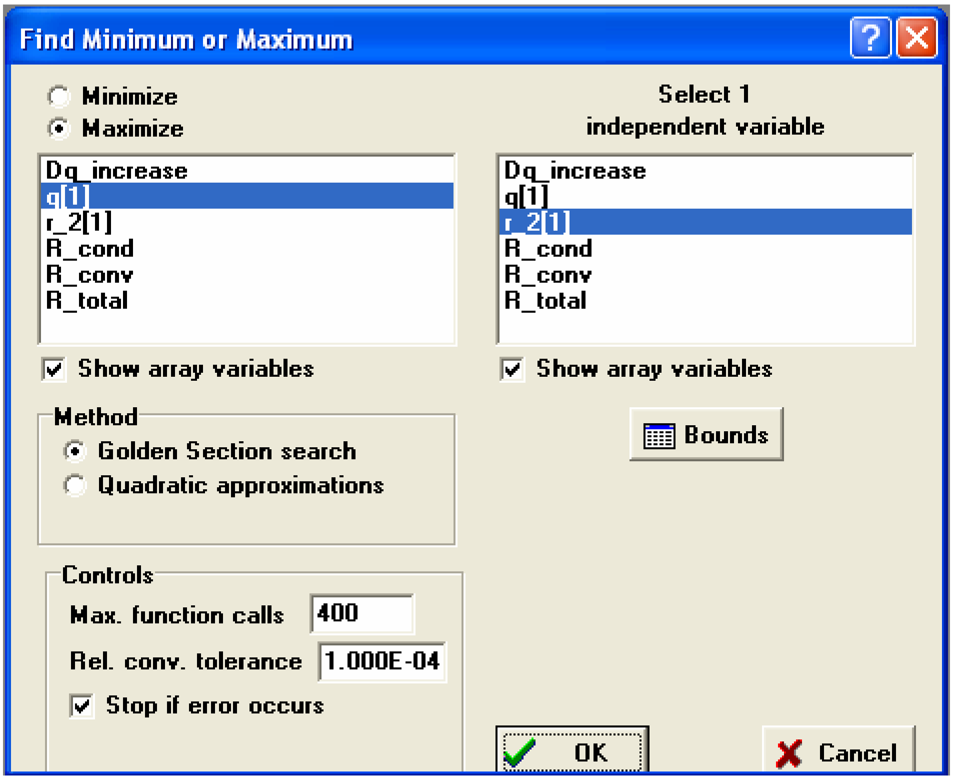
1- Governing equations or the equation window.



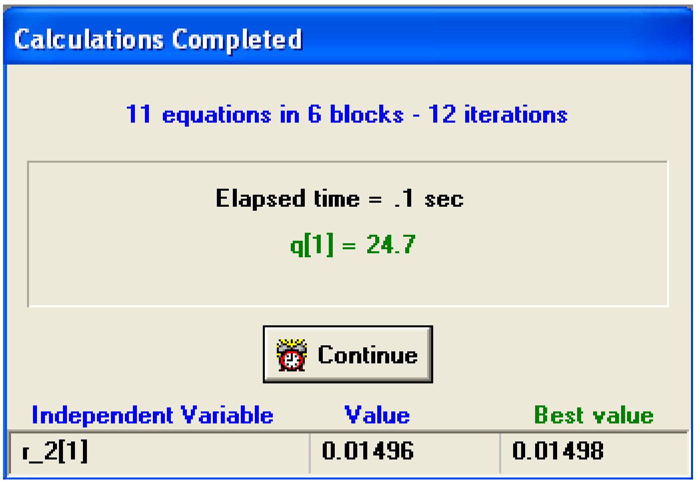
2- Press the following



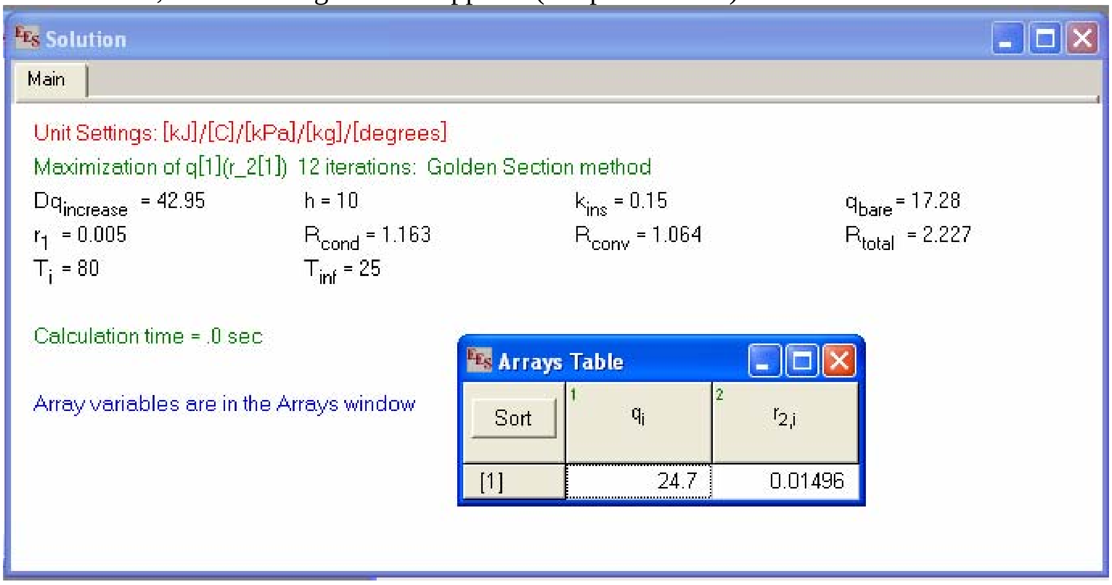
3- Change the dialog box to appear as the following one



4- Press OK, the following window appears with the solution



5- Press continue, the following window appears (out put window)



6- Out put graphical representations