

Tutorial—Five Quick Problems

Tutorials will use the **Standard User Mode** to highlight the simplicity in using this software. Advanced Users may want to use the **Power User Mode** and examples are shown at the end of each Tutorial.

All Tutorials are shown with the US unit system.

Problem 3

Suppose you decide to stick with the aluminum beam but you're concerned about the deflection.

You'd like to limit the deflection to $-.1$ inch by resizing the beam cross section. For example, if you increase the dimension of side b , the deflection should decrease. The problem is how much do you change side b ?

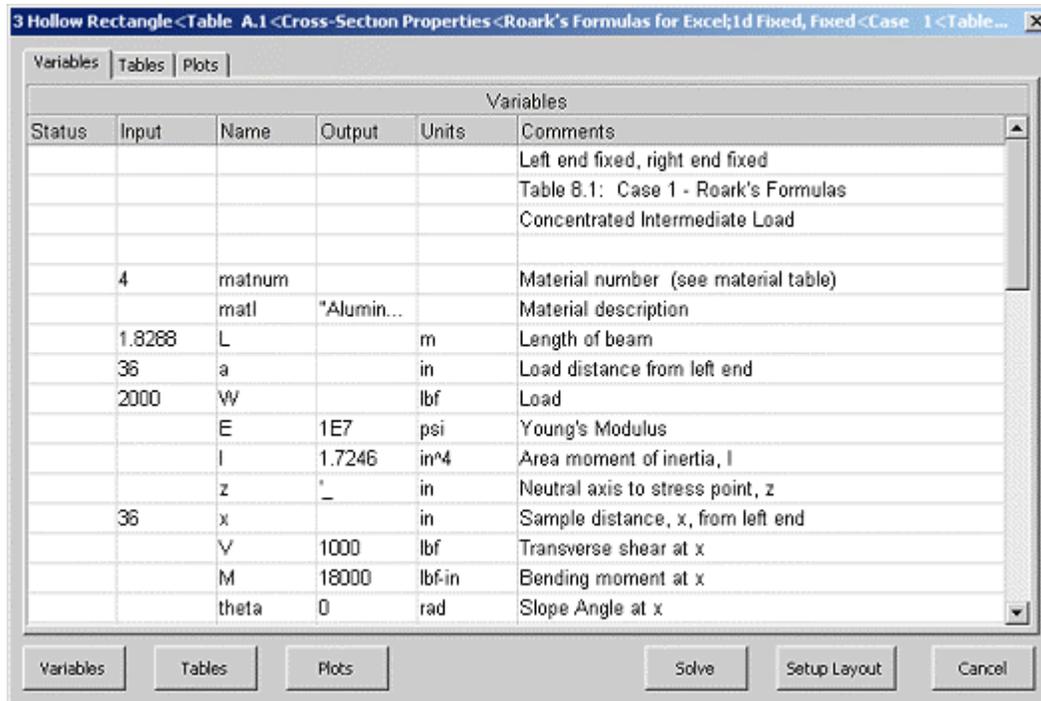
You could simply keep entering data and solving until the problem is solved. Alternatively you could use a powerful iterative solving capability available in this product. To do so and learn more, please visit Problem 3 under the Power User Mode for further details.

Power User Mode Approach

The following series of problems uses the Power User Mode approach in the Roark's Formulas for Excel Explorer.

Problem 3

Suppose you decide to stick with the aluminum beam but you're concerned about the deflection.

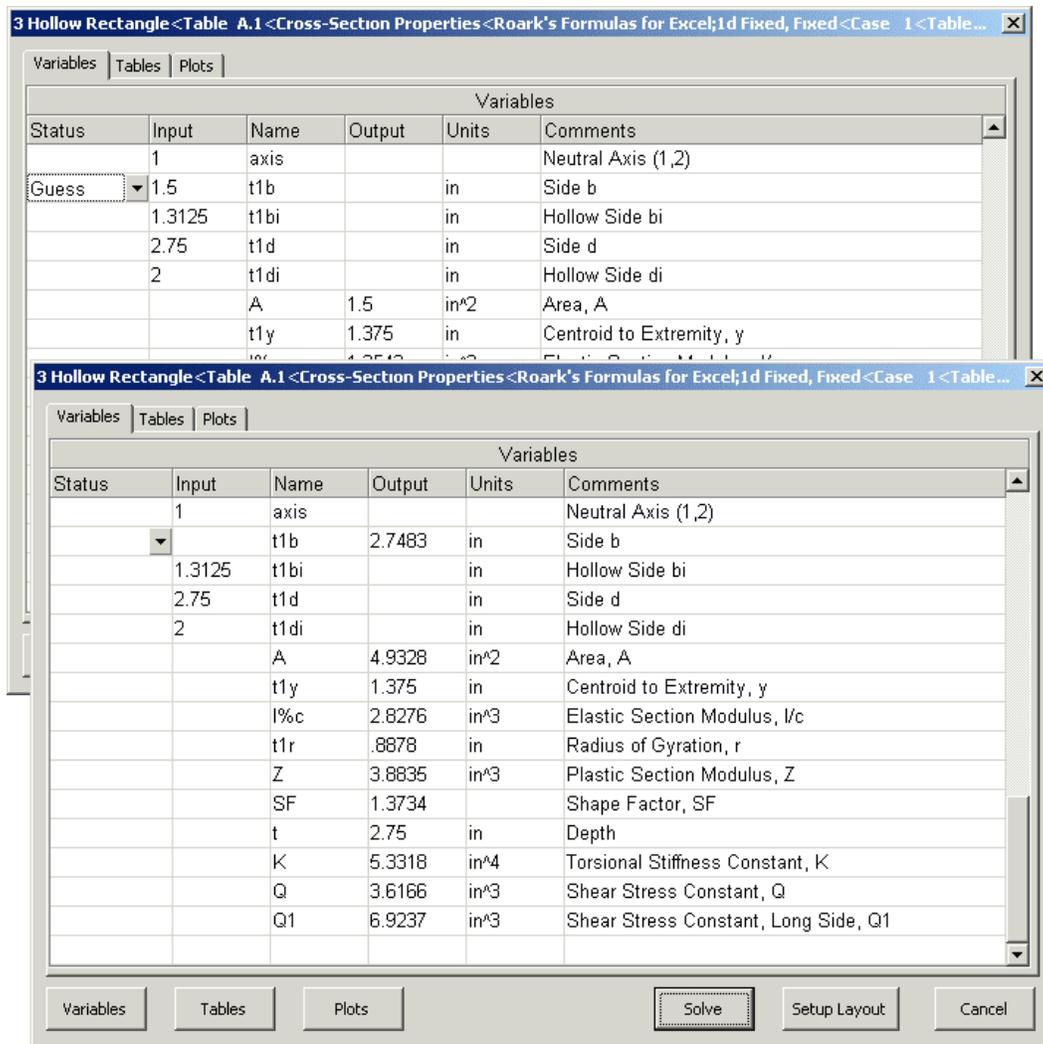


You'd like to limit the deflection to -0.1 inch by resizing the beam cross section. For example, if you increase the dimension of side b , the deflection should decrease. The problem is, how much do you change side b ? The answer is to let the application backsolve for the solution.

Enter -0.1 as the input value for variable y , delete the input for side b and click Solve.

No solution... Don't panic. The application includes capabilities for both direct and iterative solutions. The Direct Solver solves equations that do not require iteration. For example, the Direct Solver can solve the equation $a+b = c/d$ in four different ways depending on which three of the four variables are known. Iterative solutions are required for problems involving simultaneous equations or equations with unknowns that cannot be isolated. This must be a job for the Iterative Solver!

To invoke the Iterative Solver, type a **G** in the Status Field of the $t1b$ variable. You can also click in the status field and select Guess status. This indicates that the value in the input field will be the initial guess for $t1b$. Now when you click Solve, the program will solve repeatedly using updated guesses until the dimension for side b results in the required deflection.



Success!

Click on Setup Layout button, check the required options on setup dialog boxes appearing in sequence and click on Finish button. The revised beam design model including the description, definition sketch, selected Input/Output Variables and Plots are transferred to Excel as shown in the following.

Input	Value	Unit	Comment
matnum	4		Material number (see material table)
L	1.8288	m	Length of beam
a	36	in	Load distance from left end
W	2000	lbf	Load
x	36	in	Sample distance, x, from left end
y	-0.1	in	Deflection at x
axis	1		Neutral Axis (1,2)
t1bi	1.3125	in	Hollow Side bi
t1d	2.75	in	Side d
t1di	2	in	Hollow Side di

Output	Value	Unit	Comment
matl	Aluminum - wrought, 6061 T6		Material description
E	10000000	psi	Young's Modulus
z		in	Neutral axis to stress point, z
V	1000	lbf	Transverse shear at x
M	18000	lbf-in	Bending moment at x
st		psi	Fiber stress at stress point z at location x
RA	1000	lbf	Vertical reaction at left end
MA	-18000	lbf-in	Bending moment at left end
thetaA	0	rad	Slope Angle at left end
yA	0	in	Deflection at left end
RB	1000	lbf	Vertical reaction at right end
MB	-18000	lbf-in	Bending moment at right end
thetaB	0	rad	Slope angle at right end
yB	0	in	Deflection at right end
t1y	1.375	in	Centroid to Extremity, y
t	2.75	in	Depth

Plots: