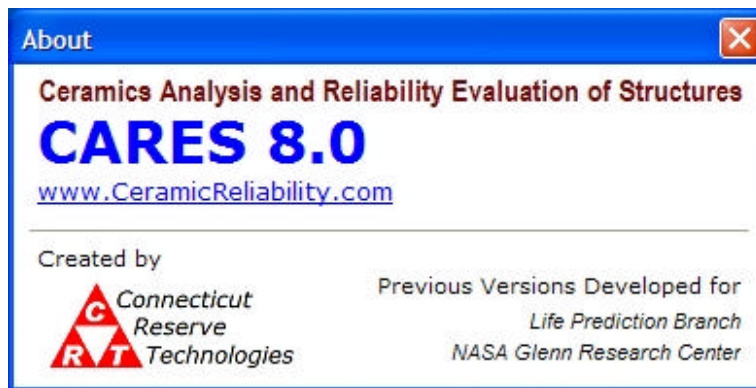
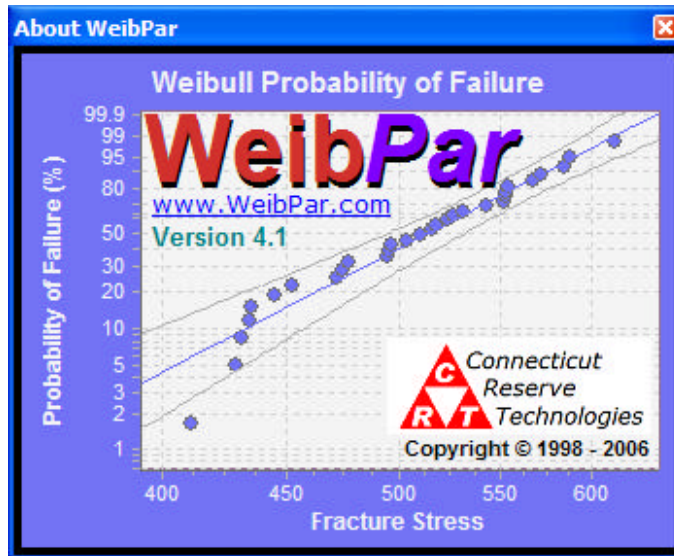


WeibPar and CARES Advanced Functions User Guide



Contents

Effective Volume and Area Calculations

Effective Volume and Area Calculations

WeibPar may be utilized in conjunction with CARES to calculate the effective volume or area of specimens or components given a finite element model.

There are two methods for calculating the effective volume or area. The first method is utilized when the effective volume or area is associated with an uncensored data set. In this case the effective volume or area is calculated as a function of the two-parameter Weibull moduls. The Weibull material scale parameter (Sig Not) is automatically calculated for each set. The second method is utilized when the user simply wants to calculate the effective volume or area as a function of an entered Weibull modulus.

Provisions:



- Fast Fracture Reliability only
- A single material

The following steps outline the process:

1. Create and solve the finite element model.
2. Open CARES and follow the steps below to create an *.ICL file.
 - a. Create a new Project
 - b. Create the Neutral file
 - c. Enter dummy Weibull parameters using the **Direct Input** option
 - d. Perform the **Component Reliability** calculation



A successful component reliability calculation is necessary for the rest of the procedure. See the CARES User guide for more details on CARES execution.
3. Close CARES

METHOD 1 – *for use in conjunction with an uncensored failure data set*

4. Open WeibPar
5. Open an uncensored data set
6. In the “Analysis Options Dialog” set the Specimen Geometry to Finite Element Model.
7. Select the Flaw Type that matches the material in the CARES Input file.
8. Within the Finite Element Model section
 - a. Click  (Set File) and utilize the dialog to select the *.ICL file created in step 2 above.
 - b. Click  (Edit File) to open CARES in WeibPar Edit mode.

- c. On the Materials page set the Parameter Options for one of the materials to **Override**.
 - d. [File | Save]
 - e. [File | Exit]
9. Click OK to perform the calculations.

METHOD 2 – *for use with direct entering of a Weibull modulus*

10. Open WeibPar
11. Select the menu option [Tools | CARES Interface...]
12. Enter a Weibull Modulus $M = 10.0$
13. Within either the SPECIMEN or COMPONENT section
 - a. Click  (Set ICL) and utilize the dialog to select the ICL file created in step 2.
 - b. Click  (Edit ICL) to open CARES in WeibPar Edit mode.
 - c. On the Materials page set the Parameter Options for one of the materials to **Override**.
 - d. [File | Save]
 - e. [File | Exit]
14. Click **Calculate Effective Volume/Area**

NOTE:

Mesh sensitivity studies should be performed when calculating the effective volume or area via the procedures outlined above.

EXAMPLE: Four-point Bend Bar

A 4-point bend bar 40x20x3x4 was modeled first with a coarse mesh of 26 elements and a second time with 1600 elements.

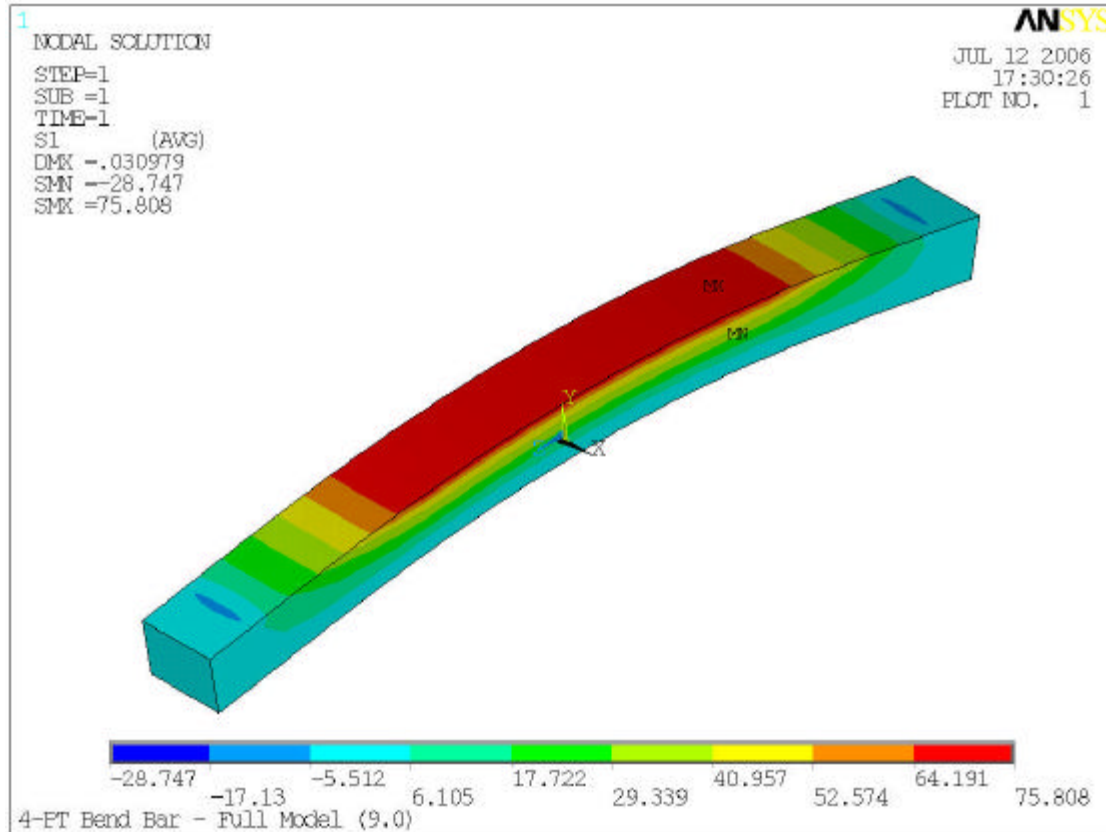


Figure 1 – Four-point Bend Bar

Effective Volume Results:

	i	M	Sstar	Smax	Pf	Eff
COARSE	1	10.000000	99.01037	67.642	0.500001	31.2945
FINE	1	10.000000	99.01037	75.576	0.524400	11.0678

NOTES:

- Mesh refinement leads to a 65% change in the Effective Volume calculation.
- The closed form calculation for the Effective Volume of a bend bar of this size with a Weibull modulus of 10.0 is 11.9008 mm³.
- The ANSYS nodal maximum principle stresses were 75.98 MPa and 75.81 MPa for the coarse and fine models respectively. The difference from the ANSYS max stresses compared with those from CARES (labeled Smax above) is due to the fact that CARES utilizes integration point stresses instead of nodal stresses.