FLCDF

PURPOSE

Compute the standard form of the fatigue-life (also known as the Birnbaum-Saunders) cumulative distribution function.

DESCRIPTION

The fatigue-life distribution can be defined as the average of the inverse Gaussian distribution and the reciprocal inverse Gaussian distribution (that is, (1/2)*(igpdf(x,γ) + rigpdf(x,γ)) where igpdf and rigpdf are the probability density functions for these distributions and γ is the shape parameter. The cumulative distribution has the form:

$$F(x) = \frac{\text{igcdf}(x, \gamma) + \text{rigcdf}(x, \gamma)}{2} \qquad \text{for } x > 0 \qquad \textbf{(EQ 8-211)}$$

where igcdf and rigcdf are the cumulative distribution functions of the inverse Gaussian and the reciprocal inverse Gaussian distributions. The above equation reduces to:

$$F(x) = \Phi\left(\frac{1}{\gamma}\left(\sqrt{x} - \sqrt{\frac{1}{x}}\right)\right) \qquad \text{for } x > 0 \qquad \textbf{(EQ 8-212)}$$

where Φ is the standard normal cumulative distribution function.

SYNTAX

LET <y2> = FLCDF(<y1>,<gamma>) <SUBSET/EXCEPT/FOR qualification>

where <y1> is a variable, a number, or a parameter;

<y2> is a variable or a parameter (depending on what <y1> is) where the computed fatigue-life cdf value is stored;

<gamma> is a positive integer (the shape parameter);

and where the <SUBSET/EXCEPT/FOR qualification> is optional.

EXAMPLES

LET A = FLCDF(3,10)

LET Y = FLCDF(X1,10)

NOTE 1

The general form of the cumulative distribution function is:

$$F(x) = \Phi\left(\frac{1}{\gamma}\left(\sqrt{\frac{x}{\mu}} - \sqrt{\frac{\mu}{x}}\right)\right) \qquad \text{for } x > 0 \qquad \textbf{(EQ 8-213)}$$

where μ is a location parameter and Φ is the standard normal cumulative distribution function. See topic (3) under the General considerations section at the beginning of this chapter for a discussion of generating cdf function values for the general form of the distribution.

NOTE 2

The fatigue-life distribution is nearly symmetric and moderate tailed for small gamma. It is highly skewed and long tailed for large gamma. It approaches normality as gamma approaches zero.

DEFAULT

None

SYNONYMS

None

RELATED COMMANDS

FLPDF	=	Compute the fatigue-life probability density function.
FLPPF	=	Compute the fatigue-life percent point function.
IGPDF	=	Compute the inverse Gaussian probability density function.
IGCDF	=	Compute the inverse Gaussian cumulative distribution function.
IGPPF	=	Compute the inverse Gaussian percent point function.
RIGPDF	=	Compute the reciprocal inverse Gaussian probability density function.

NORCDF = Compute the normal cumulative distribution function.

REFERENCE

"Continuous Univariate Distributions - 1," Johnson and Kotz, Houghton Mifflin, 1970 (chapter 15).

"Methods for Statistical Analysis of Reliability and Life Data," Mann, Schaffer, and Singpurwalla, Wiley, 1974 (pp. 150-155).

APPLICATIONS

Reliability

IMPLEMENTATION DATE

90/5

PROGRAM

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SEGMENT 1 COORDINATES 70 38 75 38; SEGMENT 1 PATTERN SOLID
SEGMENT 2 COORDINATES 70 34 75 34; SEGMENT 2 PATTERN DASH
SEGMENT 3 COORDINATES 70 30 75 30; SEGMENT 3 PATTERN DOT
SEGMENT 4 COORDINATES 70 26 75 26; SEGMENT 4 PATTERN DA 2
LEGEND 1 GAMMA = 1; LEGEND 1 COORDINATES 76 37
LEGEND 2 GAMMA = 2; LEGEND 2 COORDINATES 76 33
LEGEND 3 GAMMA = 5; LEGEND 3 COORDINATES 76 29
LEGEND 4 GAMMA = .5; LEGEND 4 COORDINATES 76 25
YLIMITS 0 1; MAJOR YTIC NUMBER 6
MINOR YTIC NUMBER 1; YTIC DECIMAL 1
XLIMITS 0 3
TITLE FLCDF FOR VARIOUS VALUES OF GAMMA
X1LABEL X; Y1LABEL PROBABILITY
LINES SOLID DASH DOT DASH2
PLOT FLCDF(X,1) FOR X = 0.01 0.01 3 AND
PLOT FLCDF(X,2) FOR X = 0.01 0.01 3 AND
PLOT FLCDF(X,5) FOR X = 0.01 0.01 3 AND
PLOT FLCDF(X,0.5) FOR X = 0.1 0.01 2.5
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