FLPDF

PURPOSE

Compute the standard form of the fatigue-life (also known as the Birnbaum-Saunders) probability density 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. This reduces to:

$$f(x) = \left(\frac{1+x}{2}\right)\text{igpdf}(x,\gamma) \qquad \text{for } x > 0 \qquad \textbf{(EQ 8-214)}$$

The pdf for the general fatigue-life distribution can be defined without reference to the igpdf as:

$$f(x) = \left(\frac{1}{2\sqrt{2\pi}\gamma^2\beta x^2}\right)\left(\frac{x^2-\mu^2}{\sqrt{\frac{x}{\mu}}-\sqrt{\frac{\mu}{x}}}\right)e^{\left(\frac{-1}{2\gamma^2}\left(\frac{x}{\mu}+\frac{\mu}{x}-2\right)\right)} \qquad \text{for } x > 0 \qquad \textbf{(EQ 8-215)}$$

where μ is the location parameter and β is the shape parameter. DATAPLOT sets μ and β to 1 in the FLPDF function. See topic (3) under the General considerations section at the beginning of this chapter for a discussion of generating pdf function values for the general form of the distribution.

The fatigue-life distribution has mean $\mu(1+\gamma^2/2)$ and standard deviation $\mu\gamma$*SQRT(1+(5/4)*γ^2).

SYNTAX

LET <y2> = FLPDF(<y1>,<gamma>) <SUBSET/EXCEPT/FOR qualification>
where <y1> is a variable or a parameter;
<y2> is a variable or a parameter (depending on what <y1> is) where the computed fatigue-life pdf value is stored;
<gamma> is a positive integer (the shape parameter);
and where the <SUBSET/EXCEPT/FOR qualification> is optional.

EXAMPLES

LET A = FLPDF(3,10)
LET Y = FLPDF(X1,10)

NOTE

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

FLPPF	=	Compute the fatigue-life percent point function.
FLCDF	=	Compute the fatigue-life cumulative distribution function.
NORCDF	=	Compute the normal cumulative distribution function.
NORPDF	=	Compute the normal probability density function.
NORPPF	=	Compute the normal percent point function.
IGPDF	=	Compute the inverse Gaussian probability density function.
IGPPF	=	Compute the inverse Gaussian percent point function.
IGCDF	=	Compute the inverse Gaussian cumulative distribution function.
RIGPDF	=	Compute the reciprocal inverse Gaussian probability density function.
RIGPPF	=	Compute the reciprocal inverse Gaussian percent point function.
RIGCDF	=	Compute the reciprocal inverse Gaussian 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 69 88 74 88; SEGMENT 1 PATTERN SOLID
SEGMENT 2 COORDINATES 69 84 74 84; SEGMENT 2 PATTERN DASH
SEGMENT 3 COORDINATES 69 80 74 80; SEGMENT 3 PATTERN DOT
SEGMENT 4 COORDINATES 69 76 74 76; SEGMENT 4 PATTERN DA2
LEGEND 1 GAMMA = 1; LEGEND 1 COORDINATES 75 87
LEGEND 2 GAMMA = 2; LEGEND 2 COORDINATES 75 83
LEGEND 3 GAMMA = 5; LEGEND 3 COORDINATES 75 79
LEGEND 4 GAMMA = .5; LEGEND 4 COORDINATES 75 75
TITLE PLOT FLPDF FOR VARIOUS VALUES OF GAMMA; LINES SOLID DASH DOT DASH2
X1LABEL X; Y1LABEL PROBABILITY
YLIMITS 0 1.2; MAJOR YTIC MARK NUMBER 4; YTIC OFFSET 0 0.1
PLOT FLPDF(X,1) FOR X = 0.01 0.01 3 AND
PLOT FLPDF(X,2) FOR X = 0.01 0.01 3 AND
PLOT FLPDF(X,5) FOR X = 0.1 0.01 3 AND
PLOT FLPDF(X,0.5) FOR X = 0.2 0.01 3
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