

VONPDF**PURPOSE**

Compute the Von Mises probability density function with shape parameter κ .

DESCRIPTION

The standard form of the Von Mises probability density function is:

$$f(x) = \frac{e^{\kappa \cos(x)}}{2\pi I_0(\kappa)} \quad -\pi \leq x \leq \pi \quad (\text{EQ 8-350})$$

where κ is the shape parameter and I_0 is the modified Bessel function of order zero. The Von Mises distribution is a circular function with a period of 2π . If the input argument is outside the interval $(-\pi, \pi)$, DATAPLOT converts it to the equivalent argument in that interval.

A shape parameter of 0 reduces to a rectangular distribution on the $(-\pi, \pi)$ interval. The Von Mises distribution approaches a normal distribution as κ gets large.

SYNTAX

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

where <y1> is a variable, number, or parameter containing values in the interval $(-\pi, \pi)$;

 is a non-negative number, parameter, or variable;

<y2> is a variable or a parameter (depending on what <x> and are) where the computed pdf value is stored;

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

EXAMPLES

LET A = VONPDF(0.5,0)

LET Y = VONPDF(X1,4)

NOTE 1

For values of κ less than the logarithm of the largest double precision number (this is approximately 700 for 32 bit machines), the Von Mises probability is calculated from the definition. The DBES10 routine from the SLATEC library is used to calculate the modified Bessel function. For κ values larger than this, a normal approximation with a standard deviation of $\text{SQRT}(\kappa-0.5)$ is used (see the Mardia paper listed in the REFERENCE section below).

NOTE 2

The general form of the Von Mises probability density function is:

$$f(x) = \frac{e^{\kappa \cos(x - \mu)}}{2\pi I_0(\kappa)} \quad -\pi \leq x \leq \pi \quad (\text{EQ 8-351})$$

where μ is a location parameter. See topic (3) under the General considerations section at the beginning of this chapter for a discussion of generating pdf values for the general form of the distribution. As κ approaches infinity, the density concentrates to a single point (the location parameter μ). The mean is μ and the standard deviation is $\text{sqrt}(1 - I_1(\kappa)/I_0(\kappa))$ where I_0 and I_1 are the modified Bessel functions of order 0 and 1 respectively.

DEFAULT

None

SYNONYMS

None

RELATED COMMANDS

VONCDF	=	Compute the Von Mises cumulative distribution function.
VONPPF	=	Compute the Von Mises percent point function.
SEMCDF	=	Compute the semi-circular cumulative distribution function.
SEMPDF	=	Compute the semi-circular probability density function.
SEMPPF	=	Compute the semi-circular percent point function.
NORCDF	=	Compute the normal cumulative distribution function.

NORPDF = Compute the normal probability density function.
NORPPF = Compute the normal percent point function.

REFERENCE

“Algorithm AS 86: The Von Mises Distribution Function,” Mardia, Applied Statistics, 24, 1975 (pp. 268-272).

“Algorithm 518, Incomplete Bessel Function I0: The Von Mises Distribution,” Hill, ACM Transactions on Mathematical Software, Vol. 3, No. 3, September 1977, Pages 279-284.

“Statistical Distributions,” 2nd. Edition, Evans, Hastings, and Peacock, John Wiley and Sons, 1993, (chapter 39).

APPLICATIONS

Data Analysis

IMPLEMENTATION DATE

94/10

PROGRAM

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TITLE VON MISES DISTRIBUTIONS
XILABEL X
YILABEL PROBABILITY
PLOT VONPDF(X,0) FOR X = -PI 0.1 PI AND
PLOT VONPDF(X,0.5) FOR X = -3.1 0.1 3.1 AND
PLOT VONPDF(X,1) FOR X = -3.1 0.1 3.1 AND
PLOT VONPDF(X,2) FOR X = -3.1 0.1 3.1 AND
PLOT VONPDF(X,4) FOR X = -3.1 0.1 3.1
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