NAG Toolbox for MATLAB

g05fs

1 Purpose

g05fs generates a vector of pseudo-random variates from a von Mises distribution with concentration parameter κ.

2 Syntax

```
[t, ifail] = g05fs(vk, n)
```

3 Description

The von Mises distribution is a symmetric distribution used in the analysis of circular data. The probability density function of this distribution on the circle with mean direction $\mu_0 = 0$ and concentration parameter kappa, κ, can be written as:

$$f(\theta) = \frac{e^{\kappa \cos \theta}}{2\pi I_0(\kappa)},$$

where θ is reduced modulo 2π so that $-\pi \leq \theta < \pi$ and $\kappa \geq 0$. For very small κ the distribution is almost the uniform distribution, whereas for $\kappa \rightarrow \infty$ all the probability is concentrated at one point.

The n variates, $\theta_1, \theta_2, \ldots, \theta_n$, are generated using an envelope rejection method with a wrapped Cauchy target distribution as proposed by Best and Fisher 1979 and described by Dagpunar 1988.

4 References

Best D J and Fisher N I 1979 Efficient simulation of the von Mises distribution *Appl. Statist.* **28** 152–157

Dagpunar J 1988 *Principles of Random Variate Generation* Oxford University Press

Mardia K V 1972 *Statistics of Directional Data* Academic Press

5 Parameters

5.1 Compulsory Input Parameters

1: **vk – double scalar**

κ, the concentration parameter of the required von Mises distribution.

Constraint: **vk** > 0.0.

2: **n – int32 scalar**

n, the number of random variates required.

Constraint: **n** ≥ 1.

5.2 Optional Input Parameters

None.

5.3 Input Parameters Omitted from the MATLAB Interface

None.

5.4 Output Parameters

1: **t(n) – double array**

The n random variates from the specified von Mises distribution, $\theta_1, \theta_2, \ldots, \theta_n$.

2: **ifail – int32 scalar**

0 unless the function detects an error (see Section 6).

6 Error Indicators and Warnings

Errors or warnings detected by the function:

ifail $= 1$

On entry, **vk** ≤ 0.0,
or **n** < 1.

7 Accuracy

Not applicable.

8 Further Comments

For a given number of random variates the generation time increases slightly with increasing κ.

If **vk** is supplied too large (i.e., **vk** $> \sqrt{}$x02al()) then floating-point overflow will occur in internal calculation.

9 Example

```
vk = 2;
n = int32(10);
g05za('O');
g05cb(int32(0));
[t, ifail] = g05fs(vk, n)
```

```
t =
   -1.6218
   -0.2575
   -0.2038
    0.8379
   -1.0074
   -0.6629
   -0.0986
    0.0252
    0.2702
   -0.5739
ifail =
           0
```