NAG Fortran Library Routine Document

G05EWF

Note: before using this routine, please read the Users' Note for your implementation to check the interpretation of ***bold italicised*** terms and other implementation-dependent details.

1 Purpose

G05EWF returns the next term from an autoregressive moving-average time series using a reference vector set up by G05EGF.

2 Specification

```
real FUNCTION G05EWF(R, NR, IFAIL)
INTEGER              NR, IFAIL
real                 R(NR)
```

3 Description

The routine generates the next term in the autoregressive series and stores it in a circular buffer in the reference vector. It then applies the moving-average summation and returns the result. This is equivalent to the ARMA model described under G05EGF.

4 References

Tunnicliffe-Wilson G (1979) Some efficient computational procedures for high order ARMA models *J. Statist. Comput. Simulation* **8** 301–309

5 Parameters

1: R(NR) – ***real*** array *Input/Output*

On entry: the reference vector as set up by G05EGF.

On exit: the updated reference vector.

2: NR – INTEGER *Input*

On entry: the dimension of the array R as declared in the (sub)program from which G05EWF is called.

This should be the same as in the preceding call of G05EGF.

3: IFAIL – INTEGER *Input/Output*

On entry: IFAIL must be set to 0, −1 or 1. Users who are unfamiliar with this parameter should refer to Chapter P01 for details.

On exit: IFAIL = 0 unless the routine detects an error (see Section 6).

For environments where it might be inappropriate to halt program execution when an error is detected, the value −1 or 1 is recommended. If the output of error messages is undesirable, then the value 1 is recommended. Otherwise, for users not familiar with this parameter the recommended value is 0. **When the value −1 or 1 is used it is essential to test the value of IFAIL on exit.**

6 Error Indicators and Warnings

If on entry IFAIL $= 0$ or -1, explanatory error messages are output on the current error message unit (as defined by X04AAF).

Errors or warnings detected by the routine:

IFAIL $= 1$

NR has been changed or R corrupted since it was set up by G05EGF, or since its last use by G05EWF.

7 Accuracy

Not applicable.

8 Further Comments

The time taken by the routine is of order (NA + NB), where NA is the number of autoregressive coefficients, and NB the number of moving-average coefficients, in the underlying model.

The comments made in Section 8 of the document for G05EGF, concerning the use of G05CBF, G05CCF, G05CFF and G05CGF, must be read before using this routine.

Although the reference vector may be copied like any other array, inexperienced users are strongly advised not to keep more than a single copy. Copying it at any point has the effect of starting a new, independent time series with an identical history. This facility may be useful, but it is clearly a fruitful source of confusion if misused or used by accident.

9 Example

This example program calls G05EGF to set up the reference vector for the autoregressive model

$$x_n = 0.4x_{n-1} + 0.2x_{n-2} + \epsilon_n$$

where ϵ_n is a series of independent random Standard Normal perturbations. G05EWF is then called ten times to generate a sample of observations, which are printed.

The generator mechanism used is selected by an initial call to G05ZAF.

9.1 Program Text

Note: the listing of the example program presented below uses ***bold italicised*** terms to denote precision-dependent details. Please read the Users' Note for your implementation to check the interpretation of these terms. As explained in the Essential Introduction to this manual, the results produced may not be identical for all implementations.

```
*     G05EWF Example Program Text
*     Mark 20 Revised. NAG Copyright 2001.
*     .. Parameters ..
      INTEGER          NA, NB, NR
      PARAMETER        (NA=2,NB=1,NR=NA+NB+4+NA)
      INTEGER          NOUT
      PARAMETER        (NOUT=6)
*     .. Local Scalars ..
      real             VAR, X
      INTEGER          I, IFAIL
*     .. Local Arrays ..
      real             A(NA), B(NB), R(NR)
*     .. External Functions ..
      real             G05EWF
      EXTERNAL         G05EWF
*     .. External Subroutines ..
      EXTERNAL         G05CBF, G05EGF, G05ZAF
*     .. Executable Statements ..
      CALL G05ZAF('O')
      WRITE (NOUT,*) 'G05EWF Example Program Results'
```

```
      WRITE (NOUT,*)
      CALL G05CBF(0)
      A(1) = 0.4e0
      A(2) = 0.2e0
      B(1) = 1.0e0
      IFAIL = 0
*
      CALL G05EGF(0.0e0,A,NA,B,NB,R,NR,VAR,IFAIL)
*
      DO 20 I = 1, 10
         IFAIL = 0
         X = G05EWF(R,NR,IFAIL)
         WRITE (NOUT,99999) X
   20 CONTINUE
      STOP
*
99999 FORMAT (1X,F12.4)
      END
```

9.2 Program Data

None.

9.3 Program Results

```
 G05EWF Example Program Results

       2.4084
       1.1987
       2.4778
       0.7998
       0.0452
       0.4125
       0.3784
      -1.2166
      -0.3510
       1.1631
```