NAG Toolbox for MATLAB

g13ag

1 Purpose

g13ag accepts a series of new observations of a time series, the model of which is already fully specified, and updates the 'state set' information for use in constructing further forecasts. The previous specifications of the time series model should have been obtained by using g13ae or g13af to estimate the relevant parameters. The supplied state set will originally have been produced by g13ae or g13af, but may since have been updated by earlier calls to g13ag.

A set of residuals corresponding to the new observations is returned. These may be of use in checking that the new observations conform to the previously fitted model.

2 Syntax

```
[st, anexr, ifail] = g13ag(st, mr, par, c, anx, 'nst', nst, 'npar',
npar, 'nuv', nuv)
```

3 Description

The time series model is specified as outlined in Section 3 of the documents for g13ae or g13af. This also describes how the state set, which contains the minimum amount of time series information needed to construct forecasts, is made up of

(i) the differenced series w_t (uncorrected for the constant c), for $(N - P \times s) < t \leq N$,

(ii) the d' values required to reconstitute the original series x_t from the differenced series w_t,

(iii) the intermediate series e_t, for $(N - \max(p, Q \times s)) < t \leq N$, and

(iv) the residual series a_t, for $(N - q) < t \leq N$.

If the number of original undifferenced observations was n, then $d' = d + (D \times s)$ and $N = n - d'$.

To update the state set, given a number of new undifferenced observations x_t, $t = n + 1, n + 2, \ldots, n + k$, the four series above are first reconstituted.

Differencing and residual calculation operations are then applied to the new observations and k new values of w_t, e_t and a_t are derived.

The first k values in these three series are then discarded and a new state set is obtained.

The residuals in the a_t series corresponding to the k new observations are preserved in an output array. The parameters of the time series model are not changed in this function.

4 References

None.

5 Parameters

5.1 Compulsory Input Parameters

1: **st(nst) – double array**

The state set derived from g13ae or g13af, or as modified using earlier calls of g13ag.

2: **mr(7) – int32 array**

The orders vector (p, d, q, P, D, Q, s) of the ARIMA model, in the usual notation.

Constraints:

$p, d, q, P, D, Q, s \geq 0$;
$p + q + P + Q > 0$;
$s \neq 1$;
if $s = 0$, $P + D + Q = 0$;
if $s > 1$, $P + D + Q > 0$.

3: **par(npar) – double array**

The estimates of the p values of the ϕ parameters, the q values of the θ parameters, the P values of the Φ parameters and the Q values of the Θ parameters in the model – in that order, using the usual notation.

4: **c – double scalar**

The constant to be subtracted from the differenced data.

5: **anx(nuv) – double array**

The new undifferenced observations which are to be used to update **st**.

5.2 Optional Input Parameters

1: **nst – int32 scalar**

Default: The dimension of the array **st**.

the number of values in the state set array **st**.

Constraint: **nst** $= P \times s + D \times s + d + q + \max(p, Q \times s)$. (As returned by g13ae or g13af).

2: **npar – int32 scalar**

Default: The dimension of the array **par**.

The number of ϕ, θ, Φ, Θ parameters in the model.

Constraint: **npar** $= p + q + P + Q$.

3: **nuv – int32 scalar**

Default: The dimension of the arrays **anx**, **anexr**. (An error is raised if these dimensions are not equal.)

k, the number of new observations in **anx**.

5.3 Input Parameters Omitted from the MATLAB Interface

wa, nwa

5.4 Output Parameters

1: **st(nst) – double array**

The updated values of the state set.

2: **anexr(nuv) – double array**

The residuals corresponding to the new observations in **anx**.

3: **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, **npar** $\neq p + q + P + Q$,
or the orders vector **mr** is invalid (check the constraints in Section 5).

ifail $= 2$

On entry, **nst** $\neq P \times s + D \times s + d + q + \max(Q \times s, p)$.

ifail $= 3$

On entry, **nuv** ≤ 0.

ifail $= 4$

On entry, **nwa** $< 4 \times$ **npar** $+ 3 \times$ **nst**.

7 Accuracy

The computations are believed to be stable.

8 Further Comments

The time taken by g13ag is approximately proportional to **nuv** $\times$ **npar**.

9 Example

```
st = [0.0118;
     -0.0669;
     0.1296;
     -0.0394;
     0.0422;
     0.1809;
     0.1211;
     0.0281;
     -0.2231;
     -0.1181;
     -0.1468;
     0.0835;
     5.8201;
     -0.0157;
     -0.0361;
     -0.0266;
     -0.0199;
     0.0298;
     0.029;
     0.0147;
     0.0373;
     -0.0931;
     0.0223;
     -0.0172;
     -0.0353;
     -0.0413];
mr = [int32(0);
     int32(1);
     int32(1);
     int32(0);
     int32(1);
     int32(1);
     int32(12)];
```

```
par = [0.327;
     0.627];
c = 0;
anx = [5.8861;
     5.8348;
     6.0064;
     5.9814;
     6.0403;
     6.157;
     6.3063;
     6.3261;
     6.1377;
     6.0088;
     5.8916;
     6.0039];
[stOut, anexr, ifail] = g13ag(st, mr, par, c, anx)
```

```
stOut =
    0.0660
   -0.0513
    0.1716
   -0.0250
    0.0589
    0.1167
    0.1493
    0.0198
   -0.1884
   -0.1289
   -0.1172
    0.1123
    6.0039
    0.0444
   -0.0070
    0.0253
    0.0019
    0.0354
   -0.0460
    0.0374
    0.0151
   -0.0237
    0.0032
    0.0188
    0.0067
    0.0126
anexr =
    0.0309
    0.0031
    0.0263
    0.0105
    0.0388
   -0.0333
    0.0265
    0.0238
   -0.0159
   -0.0020
    0.0182
    0.0126
ifail =
           0
```