

D02QYF – NAG Fortran Library Routine Document

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

D02QYF is a diagnostic routine which may be called after a call to the integrator routines D02QFF or D02QGF.

2 Specification

```

SUBROUTINE D02QYF(NEQG, INDEX, TYPE, EVENTS, RESIDS, RWORK,
1                LRWORK, IWORK, LIWORK, IFAIL)
  INTEGER        NEQG, INDEX, TYPE, EVENTS(NEQG), LRWORK,
1                IWORK(LIWORK), LIWORK, IFAIL
  real          RESIDS(NEQG), RWORK(LRWORK)

```

3 Description

This routine should be called only after a call to one of routines D02QFF and D02QGF results in the output value `ROOT = .TRUE.`, indicating that a root has been detected. D02QYF permits the user to examine information about the root detected, such as the indices of the event equations for which there is a root, the type of root (odd or even) and the residuals of the event equations.

4 References

None.

5 Parameters

- 1:** NEQG — INTEGER *Input*
On entry: the number of event functions defined for the integration routine. It must be the same parameter NEQG supplied to the setup routine D02QWF and to the integration routine (D02QFF or D02QGF).
- 2:** INDEX — INTEGER *Output*
On exit: the index k of the event equation $g_k(x, y, y') = 0$ for which the root has been detected.
- 3:** TYPE — INTEGER *Output*
On exit: information about the root detected for the event equation defined by INDEX. The possible values of TYPE with their interpretations are as follows:
- TYPE = 1
 a simple root, or lack of distinguishing information available;
- TYPE = 2
 a root of even multiplicity is believed to have been detected, that is no change in sign of the event function was found;
- TYPE = 3
 a high order root of odd multiplicity;
- TYPE = 4
 a possible root, but due to high multiplicity or a clustering of roots accurate evaluation of the event function was prohibited by round-off error and/or cancellation.

In general, the accuracy of the root is less reliable for values of `TYPE > 1`.

- 4:** EVENTS(NEQG) — INTEGER array *Output*
On exit: information about the k th event function on a very small interval containing the root, T, as output from the integration routine. All roots lying in this interval are considered indistinguishable numerically and therefore should be regarded as defining a root at T. The possible values of EVENTS(k) with their interpretations are as follows:
- EVENTS(k) = 0
 the k th event function did not have a root;
- EVENTS(k) = -1
 the k th event function changed sign from positive to negative about a root, in the direction of integration;
- EVENTS(k) = 1
 the k th event function changed sign from negative to positive about a root, in the direction of integration;
- EVENTS(k) = 2
 a root was identified, but no change in sign was observed.
- 5:** RESIDS(NEQG) — *real* array *Output*
On exit: the value of the k th event function computed at the root, T.
- 6:** RWORK(LRWORK) — *real* array *Workspace*
 This **must** be the same parameter RWORK as supplied to D02QFF or D02QGF. It is used to pass information from the integration routine to D02QYF and therefore the contents of this array **must not** be changed before calling D02QYF.
- 7:** LRWORK — INTEGER *Input*
On entry: the dimension of the array RWORK as declared in the (sub)program from which D02QYF is called.
 This must be the same parameter LRWORK as supplied to D02QWF.
- 8:** IWORK(LIWORK) — INTEGER array *Workspace*
 This **must** be the same parameter IWORK as supplied to D02QFF or D02QGF. It is used to pass information from the integration routine to D02QYF and therefore the contents of this array **must not** be changed before calling D02QYF.
- 9:** LIWORK — INTEGER *Input*
On entry: the dimension of the array IWORK as declared in the (sub)program from which D02QYF is called.
 This must be the same parameter LIWORK as supplied to D02QWF.
- 10:** IFAIL — INTEGER *Input/Output*
On entry: IFAIL must be set to 0, -1 or 1. For users not familiar with this parameter (described in Chapter P01) the recommended value is 0.
On exit: IFAIL = 0 unless the routine detects an error (see Section 6).

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 detected by the routine:

`IFAIL = 1`

An integration routine (`D02QFF` or `D02QGF`) has not been called, no root was detected or one or more of the parameters `LRWORK`, `LIWORK` and `NEQG` does not match the corresponding values supplied to `D02QWF`. Values for the arguments `INDEX`, `TYPE`, `EVENTS` and `RESIDS` will not have been set.

This error exit may be caused by overwriting elements of `IWORK`.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

See the example for Section 9 of the document for `D02QFF`.
