NAG Fortran Library Routine Document

D02QXF

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

D02QXF is a diagnostic routine which may be called after a call to either of the integration routines D02QFF and D02QGF.

2   Specification

```
SUBROUTINE D02QXF(NEQF, YP, TCURR, HLAST, HNEXT, ODLAST, ODNEXT, NSUCC,
1                  NFAIL, TOLFAC, BADCMP, RWORK, LRWORK, IWORK, LIWORK,
2                  IFAIL)
INTEGER           NEQF, ODLAST, ODNEXT, NSUCC, NFAIL, BADCMP, LRWORK,
1                  IWORK(LIWORK), LIWORK, IFAIL
real              YP(NEQF), TCURR, HLAST, HNEXT, TOLFAC, RWORK(LRWORK)
```

3   Description

This routine permits the user to extract information about the performance of one of D02QFF or D02QGF. It may only be called after a call to D02QFF or D02QGF.

4   References

None.

5   Parameters

1:    NEQF – INTEGER   *Input*

On entry: the number of first-order ordinary differential equations solved by the integration routine. It must be the same parameter NEQF supplied to the setup routine D02QWF and the integration routines D02QFF or D02QGF.

2:    YP(NEQF) – *real* array   *Output*

On exit: the approximate derivative of the solution component y_i, as supplied in y_i on output from the integration routine at the output value of T. These values are obtained by the evaluation of $y' = f(x, y)$ except when the output value of the parameter T in the call to the integration routine is TOUT and TCURR $\neq$ TOUT, in which case they are obtained by interpolation.

3:    TCURR – *real*   *Output*

On exit: the value of the independent variable which the integrator has actually reached. TCURR will always be at least as far as the output value of the argument T (from the integration routine) in the direction of integration, but may be further.

4:    HLAST – *real*   *Output*

On exit: the last successful step size used by the integrator.

5:    HNEXT – *real*   *Output*

On exit: the next step size which the integration routine would attempt.

6: ODLAST – INTEGER *Output*

On exit: the order of the method last used (successfully) by the integration routine.

7: ODNEXT – INTEGER *Output*

On exit: the order of the method which the integration routine would attempt on the next step.

8: NSUCC – INTEGER *Output*

On exit: the number of steps attempted by the integration routine that have been successful since the start of the current problem.

9: NFAIL – INTEGER *Output*

On exit: the number of steps attempted by the integration routine that have failed since the start of the current problem.

10: TOLFAC – ***real*** *Output*

On exit: a tolerance scale factor, TOLFAC $\geq$ 1.0, returned when the integration routine exits with IFAIL = 3. If RTOL and ATOL are uniformly scaled up by a factor of TOLFAC and D02QWF is called, the next call to the integration routine is deemed likely to succeed.

11: BADCMP – INTEGER *Output*

On exit: if the integration routine returned with IFAIL = 4, then BADCMP specifies the index of the component which forced the error exit. Otherwise BADCMP is 0.

12: 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 D02QXF and therefore the contents of this array **must not** be changed before calling D02QXF.

13: LRWORK – INTEGER *Input*

On entry: the dimension of the array RWORK as declared in the (sub)program from which D02QXF is called.

This must be the same parameter LRWORK as supplied to D02QWF.

14: 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 D02QXF and therefore the contents of this array **must not** be changed before calling D02QXF.

15: LIWORK – INTEGER *Input*

On entry: the dimension of the array IWORK as declared in the (sub)program from which D02QXF is called.

This must be the same parameter LIWORK as supplied to D02QWF.

16: 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 $= 1$

> An integration routine (D02QFF or D02QGF) has not been called or one or more of the parameters LRWORK, LIWORK and NEQF does not match the corresponding parameter supplied to D02QWF.

> This error exit may be caused by overwriting elements of RWORK.

7 Accuracy

Not applicable.

8 Further Comments

The user should call D02QYF for information about any roots detected by D02QFF or D02QGF.

9 Example

See Section 9 of the document for D02QFF.