

## D02MZF – 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

D02MZF interpolates components of the solution of a system of first-order differential equations from information provided by the integrators in the subchapter D02M–D02N.

### 2 Specification

```

SUBROUTINE D02MZF(TSOL, SOL, M, NEQMAX, NEQ, YSAVE, NY2DIM, RWORK,
1                IFAIL)
  INTEGER        M, NEQMAX, NEQ, NY2DIM, IFAIL
  real          TSOL, SOL(M), YSAVE(NEQMAX,NY2DIM),
1                RWORK(50+4*NEQMAX)

```

### 3 Description

D02MZF evaluates the first M components of the solution of a system of ordinary differential equations at any point using natural polynomial interpolation based on information generated by the integrator. This information must be passed unchanged to D02MZF. D02MZF should not normally be used to extrapolate outside the range of values obtained from the above routine.

### 4 References

None.

### 5 Parameters

- |    |   |               |
|----|---|---------------|
| 1: | TSOL — <i>real</i>  | <i>Input</i>  |
|    | <i>On entry:</i> the point at which the first M components of the solution are to be evaluated. TSOL should not normally be an extrapolation point. Extrapolation is permitted but not recommended. |               |
| 2: | SOL(M) — <i>real</i> array  | <i>Output</i> |
|    | <i>On exit:</i> the calculated value of the solution at TSOL.   |               |
| 3: | M — INTEGER   | <i>Input</i>  |
|    | <i>On entry:</i> the number of components of the solution whose values are required.  |               |
|    | <i>Constraint:</i> $1 \leq M \leq \text{NEQ}$ .   |               |
| 4: | NEQMAX — INTEGER  | <i>Input</i>  |
|    | <i>On entry:</i> the value used for the parameter NEQMAX when calling the integrator.   |               |
|    | <i>Constraint:</i> $\text{NEQMAX} \geq 1$ .   |               |
| 5: | NEQ — INTEGER   | <i>Input</i>  |
|    | <i>On entry:</i> the value used for the parameter NEQ when calling the integrator.  |               |
|    | <i>Constraint:</i> $1 \leq \text{NEQ} \leq \text{NEQMAX}$ .   |               |
| 6: | YSAVE(NEQMAX,NY2DIM) — <i>real</i> array  | <i>Input</i>  |
|    | <i>On entry:</i> the values provided in the array YSAVE on return from the integrator.  |               |

- 7:** NY2DIM — INTEGER *Input*  
*On entry:* the value used for the parameter NY2DIM when calling the integrator.
- 8:** RWORK(50+4\*NEQMAX) — *real* array *Input*  
*On entry:* the values provided in the array RWORK on return from the integrator.
- 9:** 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

- On entry,  $M < 1$ ,
- or  $NEQMAX < 1$ ,
- or  $NEQ < 1$ ,
- or  $M > NEQ$ ,
- or  $NEQ > NEQMAX$ .

IFAIL = 2

On entry, when accessing an element of the array RWORK an unexpected quantity was found. The user has not passed the correct array to D02MZF or has overwritten elements of this array.

IFAIL = 3

On entry, D02MZF has been called for extrapolation. Before returning with this error exit, the value of the solution at TSOL is calculated and placed in SOL.

## 7 Accuracy

The solution values returned will be of a similar accuracy to those computed by the integrator.

## 8 Further Comments

Users are recommended to employ the interpolant provided by D02XKF if using the backward differentiation integrator specified by calling setup D02NVF with the parameter PETZLD set to .FALSE..

## 9 Example

See the example for Section 9 of the document for D02NGF.

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