

NAG Toolbox for MATLAB

d02ly

1 Purpose

d02ly is a diagnostic function which may be called after a call of the integrator d02la.

2 Syntax

```
[hnext, hused, hstart, nsucc, nfail, natt, thres, thresp, ifail] =  
d02ly(neq, rwork, 'lrwork', lrwork)
```

3 Description

d02ly permits you to extract information about the performance of d02la and the setting of some optional parameters. It may be called only after a call of d02la.

4 References

None.

5 Parameters

5.1 Compulsory Input Parameters

1: **neq** – int32 scalar

the number of second-order ordinary differential equations solved by d02la. It must be the same as the parameter **neq** supplied to d02lx and d02la.

2: **rwork(lrwork)** – double array

This **must** be the same parameter **rwork** as supplied to d02la. It is used to pass information from d02la to d02ly and therefore the contents of this array **must not** be changed before calling d02ly.

5.2 Optional Input Parameters

1: **lrwork** – int32 scalar

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

This must be the same parameter **lrwork** as supplied to d02lx.

5.3 Input Parameters Omitted from the MATLAB Interface

None.

5.4 Output Parameters

1: **hnext** – double scalar

The next step size which d02la, if called, would attempt.

2: **hused** – double scalar

The last successful step size used by d02la.

3: **hstart – double scalar**

The initial step size used on the current integration problem by d02la.

4: **nsucc – int32 scalar**

The number of steps attempted by d02la that have been successful since the start of the current problem.

5: **nfail – int32 scalar**

The number of steps attempted by d02la that have failed since the start of the current problem.

6: **natt – int32 scalar**

The number of steps attempted before the initial step was successful. Over a large number of problems the cost of an attempted step of this type is approximately half that of a normal attempted step.

7: **thres(neq) – double array**

The i th solution threshold value used in the error control strategy. (See d02lx.)

8: **thresp(neq) – double array**

The i th derivative threshold value used in the error control strategy. (See d02lx.)

9: **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

d02la has not been called, or one or both of the parameters **neq** and **lrwork** does not match the corresponding parameter supplied to d02lx.

This error exit can be caused if elements of **rwork** have been overwritten.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

```
d02la_fcn.m

function f = fcn(neq, t, y)
    r = sqrt(y(1)^2+y(2)^2)^3;
    f = zeros(2,1);
    f(1) = -y(1)/r;
    f(2) = -y(2)/r;
```

```

t = 0;
tend = 20;
y = [0.5;
     0];
yp = [0;
      1.732050807568877];
ydp = zeros(2, 1);
rwork = zeros(56,1);
twant = 2;
tnext = 2;
nwant = int32(2);
[startOut, rwork, ifail] = ...
    d02lx(0, 1e-4, zeros(2,1), zeros(2,1), int32(0), true, true, false,
rwork);
fprintf('\n T      Y(1)      Y(2)\n');
fprintf('%4.1f %10.5f %10.5f\n', t, y(1), y(2));
while (t < tend && ifail == 0)
    [t, y, yp, ydp, rwork, ifail] = d02la('d02la_fcn', t, tend, y, yp, ydp,
rwork);
    while (tnext <= t && ifail == 0)
        [ywant, ypwant, ifail] = d02lz(t, y, yp, nwant, tnext, rwork);
        fprintf('%4.1f %10.5f %10.5f\n', tnext, ywant(1), ywant(2));
        tnext = tnext + 2;
    end
end

if (ifail == 0)
    [hnext, hused, hstart, nsucc, nfail, natt, thres, thresp, ifail] = ...
        d02ly(nwant, rwork);

    fprintf('\n Number of successful steps = %d\n', nsucc);
    fprintf(' Number of failed steps      = %d\n', nfail);
end

```

T	Y(1)	Y(2)
0.0	0.50000	0.00000
2.0	-1.20573	0.61357
4.0	-1.33476	-0.47685
6.0	0.35748	-0.44558
8.0	-1.03762	0.73022
10.0	-1.42617	-0.32658
12.0	0.05515	-0.72032
14.0	-0.82880	0.81788
16.0	-1.48103	-0.16788
18.0	-0.26719	-0.84223
20.0	-0.57803	0.86339

Number of successful steps = 108
 Number of failed steps = 16