NAG Library Sub-chapter Introduction

d02m–n – Integrators for Stiff Ordinary Differential Systems

Contents

1 Introduction 2

2 References 2

1 Introduction

This sub-chapter contains the specifications of the integrators from the DASSL package, Brenan *et al.* (1996).

The DASSL integrator nag_dae_ivp_dassl_gen (d02nec) is designed for solving systems of the form, $F(t, y, y\prime) = 0$. These formulations permit solution of differential/algebraic systems (DAEs). The facilities provided are essentially those of the explicit solvers.

The DASSL integrator, nag_dae_ivp_dassl_gen (d02nec), has an associated setup function nag_dae_ivp_dassl_setup (d02mwc) which must be called first. On return from the integrator, if it is feasible to continue the integration, the associated continuation call function is nag_dae_ivp_dassl_cont (d02mcc) may be called to rest various integration parameters. The structure of the Jacobian is assumed to be full unless nag_dae_ivp_dassl_linalg (d02npc) is called following a call to the setup function to specify that the Jacobian is banded and to supply its bandwidths.

The DASSL integrator nag_dae_ivp_dassl_gen (d02nec) can solve DAEs of the fully implicit form $F(t, y, y\prime) = 0$ and therefore has increased functionality over the SPRINT integrators. Additionally nag_dae_ivp_dassl_gen (d02nec) can be used to solve difficult algebraic problems by continuation; for example, the nonlinear algebraic problem

$$f(x) = 0$$

can be solved by integrating solutions of

$$f(x) + (1 - t)g(x) = 0$$

where the solution to $f(x) + g(x) = 0$ is known. The solution of this type of problem is illustrated in Section 10 in nag_dae_ivp_dassl_gen (d02nec).

2 References

Berzins M and Furzeland R M (1985) A user's manual for SPRINT – A versatile software package for solving systems of algebraic, ordinary and partial differential equations: Part 1 – Algebraic and ordinary differential equations *Report TNER.85.085* Shell Research Limited

Brenan K, Campbell S and Petzold L (1996) *Numerical Solution of Initial-Value Problems in Differential-Algebraic Equations* SIAM, Philadelphia