1 SUMMARY

This subroutine reduces the problem of finding the minimum of a function of several variables to that of finding the minimum of a function of a single variable many times. If the function is \( f(x_1, x_2, \ldots, x_n) \) the user must provide a routine to find the minimum of the function of \( f(x_1 + d_1, x_2 + d_2, \ldots, x_n + d_n) \) for any \( x \) and \( d \).


2 HOW TO USE THE PACKAGE

2.1 The argument list and calling sequence

The single precision version

CALL VA23A (N,X,E,IPRINT,MAXIT,W,MINLIN)

The double precision version

CALL VA23AD (N,X,E,IPRINT,MAXIT,W,MINLIN)

N is an INTEGER variable set to the number of variables.

X is a REAL (DOUBLE PRECISION in the D version) array. On entry to the routine \( X(I) \) must be set to an approximation to the \( I \)th variable.

E is a REAL (DOUBLE PRECISION in the D version) array. On entry to the routine \( E(I) \) must be set to the absolute accuracy required in the \( I \)th variable.

IPRINT is an INTEGER variable which may be set to 0, 1 or 2. If it is set to 0 there will be no printing. If it is set to 1 the current value of \( x \) will be printed after every call of MINLIN. If it is set to 2 the current value of \( x \) will be printed after the 1st, \((n+2)\)th, \( \ldots \), \( (n^2) \)th, \( \ldots \), call of MINLIN.

MAXIT is an INTEGER variable set as a safety valve. The subroutine will be left automatically after MINLIN has been called MAXIT times.

W is a REAL (DOUBLE PRECISION in the D version) array used by the routine for workspace. It must be at least of length \( n(n+2) \).

MINLIN is the name of the user-supplied subroutine described in section 4. It should be declared in an EXTERNAL statement.

3 GENERAL INFORMATION

Use of common: None.

Workspace: \( n(n+2) \) words in the argument array \( W \), see above.

Input/output: None.

4 SUBROUTINE MINLIN

The user must supply a subroutine to the following specification and pass its name as the 7th argument to VA23A/AD. The choice of name is for the user — MINLIN is used here only as an example.

SUBROUTINE MINLIN(N,X,W,DIST)
N is an INTEGER variable set to the number of variables.

X and W are REAL (DOUBLE PRECISION in the D version) arrays of length N whose elements will be set to the components of two vectors \( \mathbf{x} \) and \( \mathbf{w} \).

DIST is a REAL variable to be set by the subroutine to the value of \( \lambda \) such that \( f(\mathbf{x} + \lambda \mathbf{w}) \) is a minimum.

5 METHOD

The method used is a simple variation of the naive procedure of changing one variable at a time. The variation ensures that the minimum of a quadratic function is determined exactly by \( N^2 \) calls of MINLIN. Because of this a test as to whether the required accuracy has been achieved cannot be made until MINLIN has been called \( N^2 \) times.