VECMAN	CERN Program Library	F121

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Language : Fortran or Assembler

Library: KERNLIB
Submitted: 01.06.1973
Revised: 16.09.1991

Vector Algebra

Performs various vector manipulations, such as addition of two vectors, multiplication of a vector by a scalar, scalar product, pre- and post-multiplication of a vector by a matrix.

Structure:

SUBROUTINE, and FUNCTION subprograms

User Entry Names: VADD, VSUB, VMUL, VBIAS, VSCALE, VLINCO, VUNIT, VMATR, VMATL, VCOPYN, VFIX, VFLOAT, VFILL, VZERO, VBLANK, VEXCUM, VDIST, VDIST2, VDOT, VDOTN, VDOTN2, VMOD, VASUM, VSUM, VMAXA, VMAX, VMINA, VMIN, LVMAXA, LVMAX, LVMINA, LVMIN, LVSMI, LVSMX, LVSDMI, LVSDMX, LVSIMI, LVSIMX

Notes:

VLINE is the original and obsolete name for the linear combination routine VLINCO; it was changed because it clashed with an entry point in some system library.

Usage:

The arguments in the calling sequences below are defined as follows:

A,B,X	(REAL) One-dimensional arrays of length N.
DA	(DOUBLE PRECISION) One-dimensional array of length N.
IA,IX	(INTEGER) One-dimensional arrays of length N.
C,V	(REAL) One-dimensional arrays of length M.
EX	(REAL) One-dimensional array of length 3.
G	(REAL) Two-dimensional array of dimension (M,N).
ALPHA	(REAL) Variable.
F1,F2	(REAL) Variables.
Y	(REAL) Variable.
N,M	(INTEGER) Variables.

Matrix G is assumed to be stored *row-wise*, contrary to the Fortran convention, i.e. element G_{ij} is found in word G(J,I) of the memory allocated with DIMENSION G(M,N).
Any summation $\sum$ is taken over the index I from 1 to N or over the index J from 1 to M.

Subroutines

`CALL VADD(A,B,X,N)`	$X(I) = A(I) + B(I)$	$(I = 1, 2, \ldots, N)$
`CALL VSUB(A,B,X,N)`	$X(I) = A(I) - B(I)$	$(I = 1, 2, \ldots, N)$
`CALL VMUL(A,B,X,N)`	$X(I) = A(I) * B(I)$	$(I = 1, 2, \ldots, N)$
`CALL VBIAS(A,ALPHA,X,N)`	$X(I) = A(I) + ALPHA$	$(I = 1, 2, \ldots, N)$
`CALL VSCALE(A,ALPHA,X,N)`	$X(I) = A(I) * ALPHA$	$(I = 1, 2, \ldots, N)$
`CALL VLINCO(A,F1,B,F2,X,N)`	$X(I) = A(I) * F1 + B(I) * F2$	$(I = 1, 2, \ldots, N)$
`CALL VUNIT(A,X,N)`	$x = a/\lvert a\rvert$	
	$X(I) = A(I)/VMOD(A, N)$	$(I = 1, 2, \ldots, N)$
`CALL VMATR(A,G,V,N,M)`	$v = aG$	
	$V(J) = \sum A(I) * G(J, I)$	$(J = 1, 2, \ldots, M)$
`CALL VMATL(G,C,X,N,M)`	$x = Gc$	
	$X(I) = \sum G(J, I) * C(J)$	$(I = 1, 2, \ldots, N)$
`CALL VCOPYN(A,X,N)`	$X(I) = -A(I)$	$(I = 1, 2, \ldots, N)$
`CALL VFIX(A,IX,N)`	$IX(I) = A(I)$	$(I = 1, 2, \ldots, N)$
`CALL VFLOAT(IA,X,N)`	$X(I) = IA(I)$	$(I = 1, 2, \ldots, N)$
`CALL VFILL(X,N,ALPHA)`	$X(I) = ALPHA$	$(I = 1, 2, \ldots, N)$
`CALL VZERO(IX,N)`	$IX(I) = 0$	$(I = 1, 2, \ldots, N)$
`CALL VBLANK(IX,N)`	$IX(I) = \mathtt{blank}$	$(I = 1, 2, \ldots, N)$
`CALL VEXCUM(A,EX,N)`	$EX(1) = \min(EX(1), A(1), \ldots, A(N))$	
	$EX(2) = \max(EX(2), A(1), \ldots, A(N))$	
	$EX(3) = EX(3) + \sum A(I)$	

REAL functions

`VDIST2(A,B,N)`	$(a-b)^2 = \sum (A(I) - B(I))^2$
`VDIST(A,B,N)`	$\lvert a-b\rvert = \sqrt{(a-b)^2}$
`VDOT(A,B,N)`	$ab = \sum A(I) * B(I)$
`VDOTN2(A,B,N)`	$(ab)^2/(a^2b^2)$
`VDOTN(A,B,N)`	$ab/\lvert a\rvert\lvert b\rvert$
`VMOD (A,N)`	$\lvert a\rvert = \sqrt{a^2}$
`VASUM(A,N)`	$\sum \lvert A(I)\rvert$
`VSUM (A,N)`	$\sum A(I)$
`VMAXA(A,N)`	$\max(\lvert A(1)\rvert, \lvert A(2)\rvert, \ldots, \lvert A(N)\rvert)$
`VMAX (A,N)`	$\max(A(1), A(2), \ldots, A(N))$
`VMINA(A,N)`	$\min(\lvert A(1)\rvert, \lvert A(2)\rvert, \ldots, \lvert A(N)\rvert)$
`VMIN (A,N)`	$\min(A(1), A(2), \ldots, A(N))$

INTEGER functions

`LVMAXA(A,N)`	Location of $\max \lvert \mathtt{A(I)} \rvert$
`LVMAX (A,N)`	Location of $\max \mathtt{A(I)}$
`LVMINA(A,N)`	Location of $\min \lvert \mathtt{A(I)} \rvert$
`LVMIN (A,N)`	Location of $\min \mathtt{A(I)}$
`LVSMI(A,N,INC)`	Location of $\min \mathtt{A(k)}$
`LVSMX(A,N,INC)`	Location of $\max \mathtt{A(k)}$
`LVSDMI(DA,N,INC)`	Location of $\min \mathtt{DA(k)}$
`LVSDMX(DA,N,INC)`	Location of $\max \mathtt{DA(k)}$
`LVSIMI(IA,N,INC)`	Location of $\min \mathtt{IA(k)}$
`LVSIMX(IA,N,INC)`	Location of $\max \mathtt{IA(k)}$

where $\mathtt{k} = 1, 1 + \mathtt{INC}, 1 + 2 * \mathtt{INC}, \ldots, 1 + (\mathtt{N} - 1) * \mathtt{INC}$

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