

**NAME**

CUTEST\_chprod – CUTEst tool to form the matrix-vector product of a vector with the Hessian matrix of the Lagrangian.

**SYNOPSIS**

CALL CUTEST\_chprod( data, status, n, m, goth, X, Y, VECTOR, RESULT )

**DESCRIPTION**

The CUTEST\_chprod subroutine forms the product of a vector with the Hessian matrix of the Lagrangian function  $l(x, y) = f(x) + y^T c(x)$  corresponding to the problem decoded from a SIF file by the script *sifdecode* at the point  $(x, y) = (X, Y)$ .

The problem under consideration is to minimize or maximize an objective function  $f(x)$  over all  $x \in R^n$  subject to general equations  $c_i(x) = 0$ , ( $i \in 1, \dots, m_E$ ), general inequalities  $c_i^l(x) \leq c_i(x) \leq c_i^u(x)$ , ( $i \in m_E + 1, \dots, m$ ), and simple bounds  $x^l \leq x \leq x^u$ . The objective function is group-partially separable and all constraint functions are partially separable.

**ARGUMENTS**

The arguments of CUTEST\_chprod are as follows

**data** [inout] - CUTEST\_data\_type derived type  
problem-specific private data,

**status** [out] - integer  
the output status: 0 for a successful call, 1 for an array allocation/deallocation error, 2 for an array bound error, 3 for an evaluation error,

**n** [in] - integer  
the number of variables for the problem,

**m** [in] - integer  
the total number of general constraints,

**goth** [in] - logical  
a logical variable which specifies whether the first and second derivatives of the groups and elements have already been set (goth = .TRUE.) or if they should be computed (goth = .FALSE.),

**X** [in] - real/double precision  
when goth = .FALSE., the derivatives will be evaluated at X. Otherwise X is not used.

**Y** [in] - real/double precision  
when goth = .FALSE., the derivatives will be evaluated with Lagrange multipliers Y. Otherwise Y is not used,

**VECTOR** [in] - real/double precision  
an array which gives the vector whose product with the Hessian is required,

**RESULT** [out] - real/double precision  
an array which gives the result of multiplying the Hessian by VECTOR.

**NOTE**

goth should be set to .TRUE. whenever

(1)  
a call has been made to CUTEST\_cdh, CUTEST\_csh, CUTEST\_cgdrh or CUTEST\_csgrsh at the current point, or

(2)  
a previous call to CUTEST\_chprod, with goth = .FALSE., at the current point has been made.

Otherwise, it should be set .FALSE.

**AUTHORS**

I. Bongartz, A.R. Conn, N.I.M. Gould, D. Orban and Ph.L. Toint

**SEE ALSO**

*CUTEr (and SifDec): A Constrained and Unconstrained Testing Environment, revisited*,  
N.I.M. Gould, D. Orban and Ph.L. Toint,  
ACM TOMS, **29**:4, pp.373-394, 2003.

*CUTE: Constrained and Unconstrained Testing Environment*, I. Bongartz, A.R. Conn, N.I.M. Gould and  
Ph.L. Toint, TOMS, **21**:1, pp.123-160, 1995.

cutest\_uhprod(3M), sifdecode(1).

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