

**NAME**

CUTEST\_chcprod\_threaded – CUTEst tool to form the matrix-vector product of a vector with the Hessian matrix of constraint part of the Lagrangian.

**SYNOPSIS**

CALL CUTEST\_chcprod\_threaded( status, n, m, goth, X, Y, VECTOR, RESULT, thread )

**DESCRIPTION**

The CUTEST\_chcprod\_threaded subroutine forms the product of a vector with the Hessian matrix of the constraint part of the Lagrangian function  $y^T c(x)$  of the problem decoded from a SIF file by the script *sifdecoder* 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  $c_i^l \leq c_i(x) \leq c_i^u$  ( $i \in m_E + 1, \dots, m$ ), 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\_chcprod\_threaded are as follows

**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, 4 for an out-of-range thread,

**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\_threaded, CUTEST\_csh\_threaded, CUTEST\_cgrdh\_threaded or CUTEST\_csgrsh\_threaded at the current point, or

(2)

a previous call to CUTEST\_chcprod\_threaded, with goth = .FALSE., at the current point has been made.

Otherwise, it should be set .FALSE.,

**thread** [in] - integer

thread chosen for the evaluation; threads are numbered from 1 to the value threads set when calling CUTEST\_csetup\_threaded.

## AUTHORS

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## SEE ALSO

*CUTEst: a Constrained and Unconstrained Testing Environment with safe threads*,  
N.I.M. Gould, D. Orban and Ph.L. Toint,  
Computational Optimization and Applications **60**:3, pp.545-557, 2014.

*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,  
ACM TOMS, **21**:1, pp.123-160, 1995.

cutest\_chprod\_threaded(3M), cutest\_uhprod\_threaded(3M), sifdecoder(1).