## NAME

CUTEST_cshc – CUTEst tool to evaluate the Hessian of the constraint part of the Lagrangian, in sparse format.

## SYNOPSIS

CALL CUTEST_cshc( status, n, m, X, Y, nnzh, lh, H_val, H_row, H_col )

## DESCRIPTION

The CUTEST_cshc subroutine evaluates the constraint part of the Hessian of the Lagrangian function $y^T c(x)$ for the problem decoded from a SIF file by the script *sifdecoder* at the point $(x, y) = (X,Y)$. The matrix is stored in sparse format.

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

## ARGUMENTS

The arguments of CUTEST_cshc are as follows

**status** [out] - integer
   the outputr status: 0 for a succesful 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,

**X** [in] - real/double precision
   an array which gives the current estimate of the solution of the problem,

**Y** [in] - real/double precision
   an array which gives the Lagrange multipliers,

**nnzh** [out] - integer
   the number of nonzeros in H_val,

**lh** [in] - integer
   the actual declared dimensions of H_val, H_row and H_col,

**H_val** [out] - real/double precision
   an array which gives the values of the constraint part of the Hessian matrix of the Lagrangian function evaluated at X and Y. The i-th entry of H_val gives the value of the nonzero in row H_row(i) and column H_col(i). Only the upper triangular part of the Hessian is stored,

**H_row** [out] - integer
   an array which gives the row indices of the nonzeros of the Hessian matrix of the constraint part of the Lagrangian function evaluated at X and Y, and

**H_col** [out] - integer
   an array which gives the column indices of the nonzeros of the Hessian matrix of the constraint part of the Lagrangian function evaluated at X and Y.

## AUTHORS

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

## SEE ALSO

*CUTEst: a Constrained and Unconstrained Testing Environment with safe threads*,
   N.I.M. Gould, D. Orban and Ph.L. Toint,
   Technical Report, Rutherford Appleton Laboratory, 2013.

*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_csh(3M), cutest_ush(3M), sifdecoder(1).

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