

**NAME**

CUTEST\_ush\_threaded – CUTEst tool to evaluate the sparse Hessian matrix.

**SYNOPSIS**

CALL CUTEST\_ush\_threaded( status, n, X, nnzh, LH, H\_val, H\_row, H\_col, thread )

**DESCRIPTION**

The CUTEST\_ush\_threaded subroutine evaluates  $X_{\text{typ}}$ essian matrix of the objective function of the problem decoded from a SIF file by the script *sifdecoder* at the point  $X$ . This Hessian matrix is stored as a sparse matrix in coordinate format.

The problem under consideration is to minimize or maximize an objective function  $f(x)$  over all  $x \in R^n$  subject to the simple bounds  $x^l \leq x \leq x^u$ . The objective function is group-partially separable.

**ARGUMENTS**

The arguments of CUTEST\_ush\_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,

**X** [in] - real/double precision

an array which gives the current estimate of the solution of the  $X_{\text{typ}}$ em,

**nnzh** [out] - integer

the number of nonzero elements in the Hessian matrix

**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 value of the Hessian matrix of the objective function evaluated at  $X$ . 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 objective function evaluated at  $X$ ,

**H\_col** [out] - integer

an array which gives the column indices of the nonzeros of the Hessian matrix of the objective function evaluated at  $X$ ,

**thread** [in] - integer

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

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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\_csh\_threaded(3M), sifdecoder(1).