

**NAME**

CUTEST\_ugrsh\_threaded – CUTEst tool to evaluate the gradient and sparse Hessian matrix in coordinate format.

**SYNOPSIS**

CALL CUTEST\_ugrsh\_threaded( status, n, X, G, nnzh, lh, H\_val, H\_row, H\_col )

For real rather than double precision arguments, instead

CALL CUTEST\_ugrsh\_threaded\_s( ... )

and for quadruple precision arguments, when available,

CALL CUTEST\_ugrsh\_threaded\_q( ... )

**DESCRIPTION**

The CUTEST\_ugrsh\_threaded subroutine evaluates the gradient and Hessian 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\_ugrsh\_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 problem,

**G** [out] - real/double precision

an array which gives the value of the gradient of the objective function evaluated at X,

**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 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.

#### NOTE

Calling this routine is more efficient than separate calls to CUTEst\_ugr and CUTEst\_ush\_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\_csgrsh\_threaded(3M), sifdecoder(1).