

**NAME**

CUTEST\_ugrdh\_threaded – CUTEst tool to evaluate the gradient and Hessian matrix.

**SYNOPSIS**

CALL CUTEST\_ugrdh\_threaded( status, n, X, G, lh1, H\_val, thread )

**DESCRIPTION**

The CUTEST\_ugrdh\_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 dense matrix.

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\_ugrdh\_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,

**lh1** [in] - integer

the actual declared size of the leading dimension of H\_val (with lh1 no smaller than N),

**H\_val** [out] - real/double precision

a two-dimensional array which gives the value of the Hessian matrix of the objective function evaluated at X,

**thread** [inout] - 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\_threaded and CUTEST\_udh\_threaded.

**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\_cgrdh\_threaded(3M), sifdecoder(1).

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**H\_val** [out] - real/double precision

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