

NAME

CUTEST_cshprod_threaded – CUTEst tool to form the matrix-vector product of a sparse vector with the Hessian matrix of the Lagrangian.

SYNOPSIS

```
CALL CUTEST_cshprod_threaded( status, n, goth, X, Y, nnz_vector, INDEX_nz_vector, VECTOR,
                             nnz_result, INDEX_nz_result, RESULT, thread )
```

For real rather than double precision arguments, instead

```
CALL CUTEST_cshprod_threaded_s( ... )
```

and for quadruple precision arguments, when available,

```
CALL CUTEST_cshprod_threaded_q( ... )
```

DESCRIPTION

The CUTEST_cshprod_threaded subroutine forms the product of a sparse vector with the Hessian matrix of the Lagrangian function $l(x, y) = f(x) + y^T c(x)$ corresponding to 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_cshprod_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,

n [in] - integer

the number of variables for the problem,

goth [in] - logical

a logical variable that 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,

nnz_vector [in] - integer

the number of nonzeros in the vector whose product with the Hessian is required,

INDEX_nz_vector [in] - integer

an array that gives the indices of the nonzeros of the vector whose product with the Hessian is required,

VECTOR [in] - real/double precision

an array that gives the vector whose product with the Hessian is required; only the nonzeros need be specified,

nnz_result [out] - integer

the number of nonzeros in the result obtained by multiplying the Hessian by VECTOR,

INDEX_nz_result [out] - integer

an array that gives the indices of the nonzeros in the result obtained by multiplying the Hessian by VECTOR,

RESULT [out] - real/double precision

an array that gives the result of multiplying the Hessian by VECTOR; only the nonzeros will be set,

thread [out] - integer

thread chosen for the evaluation; threads are numbered from 1 to the value threads set when calling CUTEst_csetup_threaded.

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_cgrsh_threaded at the current point, or

(2)

a previous call to CUTEst_chprod_threaded, CUTEst_cshprod_threaded or CUTEst_cshcprod, with goth = .FALSE., at the current point has been made.

Otherwise, it should be set .FALSE.

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_ushprod_threaded(3M), sifdecoder(1).