

## NAG Library Function Document

### nag\_sparse\_nherm\_basic\_diagnostic (f11btc)

#### 1 Purpose

nag\_sparse\_nherm\_basic\_diagnostic (f11btc) is the third in a suite of three functions for the iterative solution of a complex general (non-Hermitian) system of simultaneous linear equations (see Golub and Van Loan (1996)). nag\_sparse\_nherm\_basic\_diagnostic (f11btc) returns information about the computations during an iteration and/or after this has been completed. The first function of the suite, nag\_sparse\_nherm\_basic\_setup (f11brc), is a setup function; the second function, nag\_sparse\_nherm\_basic\_solver (f11bsc), is the iterative solver itself.

These three functions are suitable for the solution of large sparse general (non-Hermitian) systems of equations.

#### 2 Specification

```
#include <nag.h>
#include <nagf11.h>

void nag_sparse_nherm_basic_diagnostic (Integer *itn, double *stplhs,
    double *stprhs, double *anorm, double *sigmax, Complex work[],
    Integer lwork, NagError *fail)
```

#### 3 Description

nag\_sparse\_nherm\_basic\_diagnostic (f11btc) returns information about the solution process. It can be called either during a monitoring step of nag\_sparse\_nherm\_basic\_solver (f11bsc) or after nag\_sparse\_nherm\_basic\_solver (f11bsc) has completed its tasks. Calling nag\_sparse\_nherm\_basic\_diagnostic (f11btc) at any other time will result in an error condition being raised.

For further information you should read the documentation for nag\_sparse\_nherm\_basic\_setup (f11brc) and nag\_sparse\_nherm\_basic\_solver (f11bsc).

#### 4 References

Golub G H and Van Loan C F (1996) *Matrix Computations* (3rd Edition) Johns Hopkins University Press, Baltimore

#### 5 Arguments

- 1: **itn** – Integer \* *Output*  
*On exit:* the number of iterations carried out by nag\_sparse\_nherm\_basic\_solver (f11bsc).
- 2: **stplhs** – double \* *Output*  
*On exit:* the current value of the left-hand side of the termination criterion used by nag\_sparse\_nherm\_basic\_solver (f11bsc).
- 3: **stprhs** – double \* *Output*  
*On exit:* the current value of the right-hand side of the termination criterion used by nag\_sparse\_nherm\_basic\_solver (f11bsc).

- 4: **anorm** – double \* *Output*  
*On exit:* if **iterm** = 1 in the previous call to nag\_sparse\_nherm\_basic\_setup (f11brc), then **anorm** contains  $\|A\|_p$ , where  $p = 1, 2$  or  $\infty$ , either supplied or, in the case of 1 or  $\infty$ , estimated by nag\_sparse\_nherm\_basic\_solver (f11bsc); otherwise **anorm** = 0.0.
- 5: **sigmax** – double \* *Output*  
*On exit:* if **iterm** = 2 in the previous call to nag\_sparse\_nherm\_basic\_setup (f11brc), the current estimate of the largest singular value  $\sigma_1(\bar{A})$  of the preconditioned iteration matrix when it is used by the termination criterion in nag\_sparse\_nherm\_basic\_solver (f11bsc), either when it has been supplied to nag\_sparse\_nherm\_basic\_setup (f11brc) or it has been estimated by nag\_sparse\_nherm\_basic\_solver (f11bsc) (see also Sections 3 and 5 in nag\_sparse\_nherm\_basic\_setup (f11brc)); otherwise, **sigmax** = 0.0 is returned.
- 6: **work**[**lwork**] – Complex *Communication Array*  
*On entry:* the array **work** as returned by nag\_sparse\_nherm\_basic\_solver (f11bsc) (see also Sections 3 and 5 in nag\_sparse\_nherm\_basic\_solver (f11bsc)).
- 7: **lwork** – Integer *Input*  
*On entry:* the dimension of the array **work** (see also nag\_sparse\_nherm\_basic\_setup (f11brc)).  
*Constraint:* **lwork**  $\geq 120$ .  
**Note:** although the minimum value of **lwork** ensures the correct functioning of nag\_sparse\_nherm\_basic\_diagnostic (f11btc), a larger value is required by the iterative solver nag\_sparse\_nherm\_basic\_solver (f11bsc) (see also nag\_sparse\_nherm\_basic\_setup (f11brc)).
- 8: **fail** – NagError \* *Input/Output*  
The NAG error argument (see Section 2.7 in How to Use the NAG Library and its Documentation).

## 6 Error Indicators and Warnings

### NE\_ALLOC\_FAIL

Dynamic memory allocation failed.

See Section 2.3.1.2 in How to Use the NAG Library and its Documentation for further information.

### NE\_BAD\_PARAM

On entry, argument  $\langle value \rangle$  had an illegal value.

### NE\_INT

On entry, **lwork** =  $\langle value \rangle$ .

Constraint: **lwork**  $\geq 120$ .

### NE\_INTERNAL\_ERROR

An internal error has occurred in this function. Check the function call and any array sizes. If the call is correct then please contact NAG for assistance.

An unexpected error has been triggered by this function. Please contact NAG.

See Section 2.7.6 in How to Use the NAG Library and its Documentation for further information.

### NE\_NO\_LICENCE

Your licence key may have expired or may not have been installed correctly.

See Section 2.7.5 in How to Use the NAG Library and its Documentation for further information.

## **NE\_OUT\_OF\_SEQUENCE**

nag\_sparse\_nherm\_basic\_diagnostic (f11btc) has been called out of sequence.

## **7 Accuracy**

Not applicable.

## **8 Parallelism and Performance**

nag\_sparse\_nherm\_basic\_diagnostic (f11btc) is not threaded in any implementation.

## **9 Further Comments**

None.

## **10 Example**

See Section 10 in nag\_sparse\_nherm\_basic\_setup (f11brc).

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