

F11BCFP

NAG Parallel Library Routine Document

Note: before using this routine, please read the Users' Note for your implementation to check for implementation-dependent details. You are advised to enclose any calls to NAG Parallel Library routines between calls to Z01AAFP and Z01ABFP.

Note: you should read the the F11 Chapter Introduction before using this routine. In particular, some of the notation and terminology used in this document was introduced in Section 2.1 of the F11 Chapter Introduction.

1 Description

F11BCFP is the third in a suite of three routines for the iterative solution of a real general (nonsymmetric) system of simultaneous linear equations. F11BCFP returns information about the computations during an iteration or after this has been completed. The first routine of the suite, F11BAFP, is a set-up routine; the second routine, F11BBFP is the iterative solver itself.

These three routines are suitable for the solution of large sparse real general (nonsymmetric) systems of equations.

2 Specification

```

SUBROUTINE F11BCFP(ICNTXT, ITN, STPLHS, STPRHS, ANORM, SIGMAX,
1                IFAIL)
DOUBLE PRECISION STPLHS, STPRHS, ANORM, SIGMAX
INTEGER          ICNTXT, ITN, IFAIL

```

3 Usage

3.1 Definitions

None.

3.2 Global and Local Arguments

The following global **input** arguments must have the same value on entry to the routine on each processor and the global **output** arguments will have the same value on exit from the routine on each processor:

Global input arguments: IFAIL

Global output arguments: ITN, STPLHS, STPRHS, ANORM, SIGMAX, IFAIL

The remaining arguments are local.

3.3 Distribution Strategy

Not applicable.

3.4 Related Routines

This is the last in a suite of three routines. The other two routines are:

F11BAFP: to set up the computation

F11BBFP: to carry out the iterations

3.5 Requisites

Both F11BAFP and F11BBFP must have been called before F11BCFP. In particular, F11BCFP can only be called during a monitor step of F11BBFP or after this has completed the computation.

4 Arguments

- 1:** ICNTXT — INTEGER *Local Input*
On entry: the Library context, usually returned by a call to the Library Grid initialisation routine Z01AAFP.
Note: the value of ICNTXT **must not** be changed.
- 2:** ITN — INTEGER *Global Output*
On exit: the number of iterations carried out by F11BBFP.
- 3:** STPLHS — DOUBLE PRECISION *Global Output*
On exit: the current value of the left-hand side of the termination criterion used by F11BBFP.
- 4:** STPRHS — DOUBLE PRECISION *Global Output*
On exit: the current value of the right-hand side of the termination criterion used by F11BBFP.
- 5:** ANORM — DOUBLE PRECISION *Global Output*
On exit: the matrix norm $\|A\|_p$, where $p = 1, 2$ or ∞ , when it is used by the termination criterion in F11BBFP, either when it has been supplied to F11BAFP or it has been estimated by F11BBFP (see also Section 4 of the document for F11BAFP).
 Otherwise, ANORM = 0.0 is returned.
- 6:** SIGMAX — DOUBLE PRECISION *Global Output*
On exit: 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 F11BBFP, either when it has been supplied to F11BAFP or it has been estimated by F11BBFP (see also Section 4 of the document for F11BAFP).
 Otherwise, SIGMAX = 0.0 is returned.
- 7:** IFAIL — INTEGER *Global Input/Global Output*
 The NAG Parallel Library provides a mechanism, via the routine Z02EAFP, to reduce the amount of parameter validation performed by this routine. For a full description refer to the Z02 Chapter Introduction.
On entry: IFAIL must be set to 0, -1 or 1. For users not familiar with this argument (described in the Essential Introduction) the recommended values are:
 IFAIL = 0, if multigridding is **not** employed;
 IFAIL = -1, if multigridding is employed.
On exit: IFAIL = 0 (or -9999 if reduced error checking is enabled) unless the routine detects an error (see Section 5).

5 Errors and Warnings

If on entry IFAIL = 0 or -1, explanatory error messages are output from the root processor (or processor {0,0} when the root processor is not available) on the current error message unit (as defined by X04AAF).

5.1 Full Error Checking Mode Only

IFAIL = -2000

The routine has been called with an invalid value of ICNTXT on one or more processors.

IFAIL = -1000

The logical processor grid and library mechanism (Library Grid) have not been correctly defined, see Z01AAFP.

IFAIL = 1

F11BCFP has been called out of sequence. For example, the last call to F11BBFP did not return the termination code IREVCM = 3 or 4.

6 Further Comments

6.1 Algorithmic Detail

Not applicable.

6.2 Parallelism Detail

Not applicable.

6.3 Accuracy

Not applicable.

6.4 Computational Costs

The computational costs of F11BCFP are negligible compared to the costs of F11BBFP.

7 References

- [1] Barrett R, Berry M, Chan T F, Demmel J, Donato J, Dongarra J, Eijkhout V, Pozo R, Romine C and van der Vorst H (1994) *Templates for the Solution of Linear Systems: Building Blocks for Iterative Methods* SIAM, Philadelphia
- [2] Dias da Cunha R and Hopkins T (1994) PIM 1.1 — the parallel iterative method package for systems of linear equations user's guide — Fortran 77 version *Technical Report* Computing Laboratory, University of Kent at Canterbury, Kent CT2 7NZ, UK

8 Example

See Section 8 of the document for F11BAFP.
