F01XFFP

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.

1 Description

F01XFFP gathers the local parts of a real dense vector x of length n, distributed on the Library Grid conformally to a sparse matrix A (see Section 2.5 of the F11 Chapter Introduction). The gathered vector is then stored on one or more processors as specified by the input parameters IS and JS.

An appropriate Chapter F11 routine must have been called prior to F01XFFP in order to set up auxiliary information about the sparse matrix A in the array IAINFO. See Section 3.3 of the F11 Chapter Introduction for further information, particularly Section 3.3.2.

2 Specification

```
 SUBROUTINE F01XFFP(ICNTXT, IS, JS, N, XL, XG, IAINFO, IWORK, WORK,
1                   IFAIL)
 DOUBLE PRECISION   XL(*), XG(*), WORK(*)
 INTEGER            ICNTXT, IS, JS, N, IAINFO(*), IWORK(*), IFAIL
```

3 Usage

3.1 Definitions

The following definitions are used in describing the data distribution within this document:

m_l – the number of vector elements to be stored locally (m_l = IAINFO(3), see IAINFO).

$m_l^{\max}$ – the maximum number of vector elements stored on any processor of the Library Grid ($m_l^{\max}$ = IAINFO(5), see IAINFO).

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: N, IS, JS, IFAIL

Global output arguments: IFAIL

The remaining arguments are local.

3.3 Distribution Strategy

On entry to F01XFFP, the vector x must be distributed conformally to the sparse matrix A, i.e., the vector x must be distributed across the logical processors of the Library Grid in the same way as each of the columns of the matrix A. The local part of the vector x must be stored in the array XL. This data distribution is described in more detail in Section 2.5 of the F11 Chapter Introduction.

On exit from F01XFFP, the whole vector x is stored on the 'destination' processor(s), specified by the input parameters IS and JS.

3.4 Related Routines

Some Library routines can be used to generate or distribute real dense vectors conformally to a given real or complex sparse matrix. These vectors can then be gathered by F01XFFP.

Real vector generation: F01YEFP

Real vector scatter: F01XEFP

3.5 Requisites

The sparse matrix A must have been preprocessed to set up the auxiliary array IAINFO by an appropriate Chapter F11 routine.

Cyclic row block distribution: F11ZBFP or F11ZPFP for real or complex A, respectively.

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: IS — INTEGER *Global Input*

3: JS — INTEGER *Global Input*

On entry: the Library Grid coordinates of the destination processor(s) to which the vector x will be gathered.

If JS $= -1$, then all processors in row IS of the Library Grid will gather a copy of x. Similarly, if IS $= -1$, then all processors in column JS of the Library Grid will gather a copy of x.
If IS $=$ JS $= -1$, then all processors in the Library Grid must will gather a copy of x.

Constraint: $-1 \leq$ IS $\leq m_p - 1$ and $-1 \leq$ JS $\leq n_p - 1$.

4: N — INTEGER *Global Input*

On entry: n, the order of the vector x. It must contain the same value as the parameter N used in a prior call to the Chapter F11 routine in which the array IAINFO was initialised.

Constraint: N ≥ 1.

5: XL($*$) — DOUBLE PRECISION array *Local Input*

Note: the dimension of the array XL must be at least max(1,m_l).

On exit: the local part of the vector x.

6: XG($*$) — DOUBLE PRECISION array *Local Output*

Note: the dimension of the array XG must be at least N on the destination processor(s), as specified by the input parameters IS and JS, on all other processors, it must be at least 1.

On entry: on the destination processor(s), as specified by the input parameters IS and JS, XG the whole vector x; on all other processors, XG is not referenced.

7: IAINFO($*$) — INTEGER array *Local Input*

Note: the dimension of the array IAINFO must be at least max(30,IAINFO(2)).

On entry: the first IAINFO(2) elements of IAINFO contain information about the matrix A. The array IAINFO must have been initialised by a prior call to an appropriate Chapter F11 routine. The first IAINFO(2) elements of IAINFO **must not** be changed between successive calls to library routines involving the sparse matrix A.

Note: on exit from the Chapter F11 routine, the element IAINFO(3) contains m_l, the number of rows of the matrix stored locally, and IAINFO(5) contains $m_l^{\max}$, the maximum number of vector elements stored on any processor of the Library Grid.

8: IWORK($*$) — INTEGER array *Local Workspace*

Note: the dimension of the array IWORK must be at least IAINFO(5) on the destination processor(s), as specified by the input parameters IS and JS, and at least max(1,IAINFO(3)) on all other processors.

9: WORK(∗) — DOUBLE PRECISION array *Local Workspace*

Note: the dimension of the array WORK must be at least IAINFO(5) on the destination processor(s), as specified by the input parameters IS and JS, and at least 1 on all other processors. The array WORK is only referenced on the destination processor(s).

10: 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 = $-i$

On entry, the ith argument was invalid. This error occured either because a global argument did not have the same value on all logical processors, or because its value on one or more processors was incorrect. An explanatory message distinguishes between these two cases.

5.2 Any Error Checking Mode

IFAIL = 1

IAINFO was not initialised by a prior call to a Chapter F11 routine.

IFAIL = 2

On entry, the data stored in the arguments N and IAINFO are inconsistent. This could indicate that, after the array IAINFO was initialised, at least one of these arguments was changed between successive calls to library routines.

6 Further Comments

None.

7 References

None.

8 Example

See Section 8 of the document for F01XAFP.