

# NAG Library Routine Document

## F06SMF (ZGERU)

**Note:** before using this routine, please read the Users' Note for your implementation to check the interpretation of *bold italicised* terms and other implementation-dependent details.

### 1 Purpose

F06SMF (ZGERU) computes the rank-1 update of a complex general matrix using an unconjugated vector.

### 2 Specification

```
SUBROUTINE F06SMF (M, N, ALPHA, X, INCX, Y, INCY, A, LDA)
```

```
INTEGER M, N, INCX, INCY, LDA
COMPLEX (KIND=nag_wp) ALPHA, X(*), Y(*), A(LDA,*)
```

The routine may be called by its BLAS name *zgeru*.

### 3 Description

F06SMF (ZGERU) performs the rank-1 update operation

$$A \leftarrow \alpha xy^T + A,$$

where  $A$  is an  $m$  by  $n$  complex matrix,  $x$  is an  $m$  element complex vector,  $y$  is an  $n$ -element complex vector, and  $\alpha$  is a complex scalar.

### 4 References

None.

### 5 Parameters

- |    |   |              |
|----|---|--------------|
| 1: | M – INTEGER   | <i>Input</i> |
|    | <i>On entry:</i> $m$ , the number of rows of the matrix $A$ .   |              |
|    | <i>Constraint:</i> $M \geq 0$ .   |              |
| 2: | N – INTEGER   | <i>Input</i> |
|    | <i>On entry:</i> $n$ , the number of columns of the matrix $A$ .  |              |
|    | <i>Constraint:</i> $N \geq 0$ .   |              |
| 3: | ALPHA – COMPLEX (KIND=nag_wp)   | <i>Input</i> |
|    | <i>On entry:</i> the scalar $\alpha$ .  |              |
| 4: | X(*) – COMPLEX (KIND=nag_wp) array  | <i>Input</i> |
|    | <b>Note:</b> the dimension of the array X must be at least $\max(1, 1 + (M - 1) \times  \text{INCX} )$ .        |              |
|    | <i>On entry:</i> the $m$ element vector $x$ .   |              |
|    | If $\text{INCX} > 0$ , $x_i$ must be stored in $X(1 + (i - 1) \times \text{INCX})$ , for $i = 1, 2, \dots, M$ . |              |
|    | If $\text{INCX} < 0$ , $x_i$ must be stored in $X(1 - (M - i) \times \text{INCX})$ , for $i = 1, 2, \dots, M$ . |              |
|    | Intermediate elements of X are not referenced.  |              |

- 5: INCX – INTEGER *Input*  
*On entry:* the increment in the subscripts of X between successive elements of  $x$ .  
*Constraint:*  $\text{INCX} \neq 0$ .
- 6: Y(\*) – COMPLEX (KIND=nag\_wp) array *Input*  
**Note:** the dimension of the array Y must be at least  $\max(1, 1 + (N - 1) \times |\text{INCY}|)$ .  
*On entry:* the  $n$ -element vector  $y$ .  
 If  $\text{INCY} > 0$ ,  $y_i$  must be stored in  $Y(1 + (i - 1) \times \text{INCY})$ , for  $i = 1, 2, \dots, N$ .  
 If  $\text{INCY} < 0$ ,  $y_i$  must be stored in  $Y(1 - (N - i) \times \text{INCY})$ , for  $i = 1, 2, \dots, N$ .  
 Intermediate elements of Y are not referenced.
- 7: INCY – INTEGER *Input*  
*On entry:* the increment in the subscripts of Y between successive elements of  $y$ .  
*Constraint:*  $\text{INCY} \neq 0$ .
- 8: A(LDA,\*) – COMPLEX (KIND=nag\_wp) array *Input/Output*  
**Note:** the second dimension of the array A must be at least N.  
*On entry:* the  $m$  by  $n$  matrix  $A$ .  
*On exit:* the updated matrix  $A$ .
- 9: LDA – INTEGER *Input*  
*On entry:* the first dimension of the array A as declared in the (sub)program from which F06SMF (ZGERU) is called.  
*Constraint:*  $\text{LDA} \geq \max(1, M)$ .

## 6 Error Indicators and Warnings

None.

## 7 Accuracy

Not applicable.

## 8 Further Comments

None.

## 9 Example

None.

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