

NAG Toolbox for MATLAB

f08kq

1 Purpose

f08kq computes the minimum norm solution to a real linear least-squares problem

$$\min_x \|b - Ax\|_2.$$

2 Syntax

```
[a, b, s, rank, info] = f08kq(a, b, rcond, 'm', m, 'n', n, 'nrhs_p',
nrhs_p, 'lwork', lwork)
```

3 Description

f08kq uses the singular value decomposition (SVD) of A , where A is an m by n matrix which may be rank-deficient.

Several right-hand side vectors b and solution vectors x can be handled in a single call; they are stored as the columns of the m by r right-hand side matrix B and the n by r solution matrix X .

The problem is

3: **rcond – double scalar**

Used to determine the effective rank of A . Singular values $s(i) \leq \mathbf{rcond} \times s(1)$ are treated as zero. If $\mathbf{rcond} < 0$, *machine precision* is used instead.

5.2 Optional Input Parameters1: **m – int32 scalar**

Default: The first dimension of the array **a**.

m , the number of rows of the matrix A .

Constraint: $\mathbf{m} \geq 0$.

2: **n – int32 scalar**

Default: The second dimension of the array **a**.

n , the number of columns of the matrix A .

Constraint: $\mathbf{n} \geq 0$.

3: **nrhs_p – int32 scalar**

2: **b(ldb,*)** – complex array

The first dimension of the array **b** must be at least $\max(1, \mathbf{m}, \mathbf{n})$

The second dimension of the array must be at least $\max(1, \mathbf{nrhs_p})$

b contains the n by r solution matrix X . If $m \geq n$ and **rank** = n , the residual sum of squares for the solution in the i th column is given by the sum of squares of the modulus of elements $n + 1, \dots, m$ in that column.

3: **s(*)** – double array

Note: the dimension of the array **s** must be at least $\max(1, \min(\mathbf{m}, \mathbf{n}))$.

The singular values of A in decreasing order.

4: **rank** – int32 scalar

```

...    complex(1.14, -0.78), complex(0.070000000000000001, +1.14)];
b = [complex(2.15, -0.2);
     complex(-2.24, +1.82);
     complex(4.45, -4.28);
     complex(5.7, -6.25);
     complex(0, +0)];
rcond = 0.01;
[aOut, bOut, s, rank, info] = f08kq(a, b, rcond)

```

aOut =
Columns 1 through 4
-1.5199 -0.1371 - 0.1390i 0.2210 - 0.2638i 0.3753 +
0.4209i
-1.9194 -1.4211 -0.2911 + 0.4160i 0.0463 -
0.4369i
-0.0459 - 0.0067i 1.9985 0.9249 0.3343 +
0.4472i
-0.2659 + 0.5880i 0.1704 + 0.3519i -1.0610 0.0192
Column 5
-0.0978 + 0.0134i
-0.2470 + 0.5898i
-0.1840 + 0.1355i
0.3393 - 0.6232i
bOut =
3.9747