Embedded computing for scientific and industrial imaging applications

Lecture 12 - Solving linear system with Intel MKL

Outline

- Solves a general linear system
- DGESV
- LAPACKE_dgesv

DGESV — Solves a general linear system

http://www.netlib.org/lapack/double/dgesv.f

```
SUBROUTINE DGESV( N, NRHS, A, LDA, IPIV,  B, LDB, INFO )
```

`N` = size of system (square N × N)

`A` = matrix on input, L,U factors on output,
`dimension(LDA,K)` with `LDA, K >= N`

`LDA` = leading dimension of A (number of rows in declaration of A)

DGESV — Solves a general linear system

`NRHS` = number of right hand sides

`B` = matrix whose columns are right hand side(s) on input solution vector(s) on output.

`LDB` = leading dimension of `B`.

`INFO` = integer returning 0 if successful.

`A` = matrix on input, L,U factors on output,

`IPIV` = Returns pivot vector (permutation of rows)

```
integer, dimension(N)
```

Row I was interchanged with row `IPIV(I)`.

LAPACKE_dgesv

https://software.intel.com/en-us/node/520973#90C462DB-A8BF-48A1-AE76-5E49D4EA04AF

The routine solves for `X` the system of linear equations `A*X = B`, where `A` is an `n`-by-`n` matrix, the columns of matrix `B` are individual right-hand sides, and the columns of `X` are the corresponding solutions.

Solves a general linear system AX= B

matrix `A`

```
double A[5 * 5] = {
         6.80, -6.05, -0.45,  8.32, -9.67,
        -2.11, -3.30,  2.58,  2.71, -5.14,
         5.66,  5.36, -2.70,  4.35, -7.26,
         5.97, -4.44,  0.27, -7.17,  6.08,
         8.23,  1.08,  9.04,  2.14, -6.87
    };
```

matrix `B`

```
double B[5 * 3] = {
           4.02, -1.56,  9.81,
           6.19,  4.00, -4.09,
         - 8.22, -8.67, -4.57,
         - 7.57,  1.75, -8.61,
         - 3.03,  2.86,  8.99
     };
```

Solves a general linear system AX= B

Solution `X`

```
-0.80  -0.39   0.96

-0.70  -0.55   0.22

 0.59   0.84   1.90

 1.32  -0.10   5.36

 0.57   0.11   4.04
```