

Documentation

RRQR Factorization

Windows and Linux MEX-Files for MatLab

Mai 20th, 2008

1. Contents of the distribution file:

1.1. binary-release:

The binary release contains the following files:

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|------------------|--|
| - rrqr.m | a Matlab-Script that calls the gateway |
| - rrqrGate.dll | the Windows-MEX-File |
| - rrqrGate.mexgl | the Linux-MEX-File |
| - readme.pdf | this documentation |

1.2. source-release:

the source release contains the following files:

- | | |
|-----------------------|--|
| - rrqrGate.f | source code of the rrqr gateway |
| - rrqr.m | a Matlab-Script that calls the gateway |
| - rrqr_batch_tool.exe | a small tool for compiling the gateway (MS-Windows only) |
| - gnumex.exe | gnumex (MS-Windows only) |
| - rrqr_acm.tar.gz | rrqr sources |
| - readme.pdf | this documentation |

2. Compiling the gateway:

This part describes how to create the rrqr Gateway from source. For usage only, a binary-release is available. See paragraph 3.

2.1. Compiling under MS-Windows (32-bit):

The following tools are strictly required for an accurate compiling process.

- MinGW found on www.MinGW.org
- g95 Fortran Compiler found on www.g95.org
- LAPACK & BLAS sources found on www.netlib.org/lapack/

Install the required tools and extract the libraries if necessary. Start Matlab. Append the GUMEX folder to Matlab search path, respectively change to GNUFEX folder directly. Call gnumex from Matlab command line. Set the correct MingW root path, where Mingw is installed. Choose Mingw as linker and select g95 as language for compilation. Set the correct target processor if necessary. Declare "rrqrGate" as destination path and create the optionsfile by clicking on "Makeopts". Quit gnumex.

Execute "rrqr_batch_tool" from outside Matlab. Select correct BLAS, LAPACK & RRQR (e.g. C:\rrqrGate\rrqr_acm\ for RRQR) root folder and compile the gateway by clicking on the compile button.

Note: The BLAS source is part of the LAPACK package. if no BLAS root is declared, BLASS root will be expand from LAPACK root folder automaticaly.

Note: By clicking the check button, rrqr batch tool test availability for all needed sources.

Attention! It's essential that "makeopts.bat", "rrqrGate.f" and "rrqr_batch_tool.exe" are in the same path.

2.2. Compiling under Linux (32-bit):

The folowing tools are required for compiling the rrqr Gateway.

- g95 Fortran Compiler found on www.g95.org
- LAPACK & BLAS found on www.netlib.org/lapack/

Extract and untar rrqr_acm.tar.gz. Compile the RRQR library. For more details, see the corresponding README.

Compile the required libraries BLAS, LAPACK, if necessary. Run Matlab and change path to rrqrGate. Compile the Gateway by prompting the following line.

```
mex -fortran rrqrGate.f -L/rrqrGate/rrqr_acm/ -lrrqr
```

3. Usage:

The `rrqr.m` gateway accepts input and supplies output as described in the following.

[Q,R,p,r]=rrqr(A), where A is m-by-n, produces an m-by-n upper triangular matrix R and an m-by-m unitary matrix Q so that

$$A \cdot p = Q \cdot \begin{bmatrix} R_{11} & R_{12} \\ 0 & R_{22} \end{bmatrix}.$$

p is a permutation vector and r is rank of A.

[Q,R,p,r]=rrqr(A,'s') produce the „economy size“ decomposition. If $m \leq n$, R is m-by-n and Q is m-by-m, otherwise R is n-by-n and Q is m-by-n.

[Q,R,p,r]=rrqr(A,tol). $\frac{1}{tol}$ Specifies an upper bound on the condition number of R_{11} . If tol=0 or tol is unset, tol=“machine precision“ is chosen as default. Tol must be > 0. The tol parameter can be combined with the 's' parameter.

[B,R,p,r]=rrqr(A,C) returns a matrix B so that $B = C \cdot Q$. The tol parameter is accepted as well. **[R,p,r]=rrqr(A)** is identical to the upper cases, but does not compute Q. The tol and 's' parameters are accepted as well.