QR Mumps

What is QR Mumps?

QR Mumps is a Julia software package designed for sparse QR factorization methods. It is used to solve linear systems, least square problems, and least norm problems. It solves these types of problems in three different phases.

How does it work?

It solves problems in three different phases:

1. Analysis
2. Factorization
3. Solution -

How does it work? - Analysis

In this phase an analysis of the structural properties of the input matrix is performed in preparation for the numerical factorization phase. This includes computing a column permutation which reduces the amount of fill-in coefficients (i.e., nonzeroes introduced by the factorization). This step does not perform any floating-point operation and is, thus, commonly much faster than the factorization and solve (depending on the number of right-hand sides) phases.

How does it work? - Factorization

At this step, the actual QR or Cholesky factorization is computed. This step is the most computationally intense and, therefore, the most time consuming.

How does it work? - Solution

Once the factorization is done, the factors can be used to compute the solution of the problem through two operations:

1. Solve : this operation computes the solution of the triangular system $Rx=b$ or $R^Tx=b$;
2. Apply : this operation applies the Q orthogonal matrix to a vector, i.e., $y=Qx$ or $y=Q^Tx$.

Features/Perks

- Memory consumption control
- Fill-reducing permutations
- Multithreading
- GPU acceleration