

1 Problem Statement

We want to parallelize and implement direct solution methods and iterative solution methods and compare their performance against some more advanced state of the art algorithms.

2 Implementation Details

We first want to familiarize ourselves with the available methods before we choose which ones we are going to implement. The methods can be divided into two sets of related methods:

- One of the classic direct solution methods
 - LU decomposition
 - Cholesky factorization
 - QR factorization
- One of the state-of-the-art iterative solution methods
 - Multigrid methods
 - Conjugate gradient methods
 - A combination of the above

3 Performance Analysis

One of the goals is to find out under what conditions (i.e. problem size) iterative methods outperform direct methods. We therefore want to run the two algorithms on a sequence of varying problem sizes. We plan to log performance metrics such as execution time, speedup (the inverse execution time normalized with respect to the sequential execution time) and cache hits and misses. Furthermore, we want to compare:

- Sequential versus parallel implementations
- Changes in the number of OpenMP threads versus MPI processes
- Naive implementations versus optimized implementations

4 Task Division

Each group member will study the theoretical part of the algorithms so they can be discussed. In order for both group members to get equivalent understanding of the implementation, the parallelization and implementation of the different algorithms will be done together.

The different sections of the report will be discussed so each group member can write on the report independently to finish the final report.