Packed Storage

Packed storage involves a matrix being packed by rows into a one-dimensional array. Because the matrix A is symmetric positive definite, only the upper triangular portion needs to be stored.

Packed storage is a relatively efficient storage method that stores the matrix A in 4488 bytes. While this is the second biggest storage in terms of memory usage, it is still nearly half that of that the full storage. The time taken by packed storage is nearly identical to that of band storage, making it one of the fastest methods. Despite being fast, the number of flops that this method requires is the highest out of all the direct methods, including full storage.

While Cholesky factorisations, forward substitution, and backward substitution work on the full storage, they need modification to work with the one-dimensional array that is packed storage. This was primarily done by changing how the functions refer to A, by creating and using a map so that the functions refer to the same numbers as they do in the full storage.

Banded Storage

Banded storage is a storage method that compacts large banded systems by storing diagonals as rows in a band matrix. This is done by ordering the original A matrix and b vector using RCM storage, which reduces the bandwidth of the matrix, making the band storage smaller.

It is shown that the storage method is very efficient, with it being the second smallest file out of the storage methods that were tested, with a file size of 1848 bytes with the third fastest runtime and least number of flops. This is because, unlike some other storage methods, it only stores and operates on a smaller section of the original matrix.

Band storage only stores the diagonals of a banded system as the rows of the band matrix, and not any of the zeros of the top right or bottom left. This method results in a matrix with the same number of columns as the original and rows equal to the bandwidth of the original matrix plus 1 if it is symmetric positive definite. The bandwidth of the matrix *A* is 6 and because it is an SPD, the band form will have 7 rows resulting is a decrease of 26 rows over the original matrix.

Much like the packed storage, Because the new band matrix is no-longer symmetric positive definite, the functions to calculate the Cholesky factorization, forward and backward substitution need to be changed. The main change to these functions is how they refer to the band matrix, they refer to the matrix using a map so that the functions refer to the same numbers as they do in the full storage.