

The presented thesis is focused on the GMRES convergence analysis. The basic principles of CG, MINRES and GMRES are briefly explained. The thesis summarizes some known convergence results of these methods. The known characterizations of the matrices and the right hand sides generating the same Krylov residual spaces are summarized. Connections and the differences between the different points of view on GMRES convergence analysis are shown. We expect that if the convergence curve of GMRES applied to the nonnormal matrix A and the right hand side b seems to be determined by the eigenvalues of the matrix A then exists a matrix that is close to normal and has the same spectrum as the matrix A and for the right hand side b has the same GMRES convergence curve (We assume that the initial approximation $x_0 = 0$). Several numerical experiments are done to examine this assumption. This thesis describes an unpublished result of Gérard Meurant which is the formula for the norm of the k -th error of GMRES applied to the matrix A and right hand side b and its derivation. The upper estimate of the k -th GMRES error is derived. This estimate is minimized via spectrum.