In this thesis we consider the Lanczos algoritm and its behaviour in finite precision. Having summarized theoretical properties of the algorithm and its connection to orthogonal polynomials, we recall the idea of the Lanczos method for approximating the matrix eigenvalues. As the behaviour of the algorithm is strongly influenced by finite precision arithmetic, the linear independence of the Lanczos vectors is usually lost after a few iterations. We use the most important results from analysis of the finite precision Lanczos algorithm according to Paige, Greenbaum, Strakos and others. Based on that, we study formulation and properties of the mathematical model of finite presicion Lanczos computations suggested by Greenbaum. We carry out numerical experiments in Matlab, which support the theoretical results.