This thesis is focused on using low rank matrices in numerical mathematics. We introduce conjugate gradient method and its preconditioning which we use in other chapters. Then we describe four different approaches to approximation using low rank matrices. First we discuss classical approximation using singular value decomposition. Next, using a model problem, we describe hierarchical matrices, which are connected with applications in physics and technique. Then pseudo-skeleton decomposition is introduced. We formulate and prove a theorem about error estimate of this decomposition. We also mention algorithm Maxvol which can compute pseudo-skeletal decomposition of tall matrices. Next chapter is dedicated to probabilistic algorithms and to least-squares solver Blendenpik. In conclusions we show results of experiments focused on preconditioning using algorithm Maxvol.