Kerr metric is one of the most well-known and useful exact solutions of Einstein equations. We study various geometric properties of the Kerr spacetime in order to gain intuition for its spatial shape. In the review part we summarize basic features of the Kerr geometry, we write down Carter equations for geodesic motion in the Kerr spacetime, and we introduce kinematic characteristics of time-like and light-like congruences, such as expansion, shear and twist.

In the second part of the thesis we calculate scalars for acceleration, expansion, shear and twist — and plot the corresponding "equipotential" surfaces — for several privileged congruences, namely the Carter observers, the static observers, the zero-angular-momentum observers, the principal null congruence and the recently found non-twisting null congruence(s). We also draw surfaces radially equidistant from the horizon and surfaces spatially orthogonal to the PNC and to the twist-free congruences, as well as the surfaces of constant energy and redshift for the important time-like congruences.