Sagittarius A*, a compact source in the centre of the Milky Way, is the nearest supermassive black hole (SMBH) in our cosmic neighbourhood, where various astrophysical processes take place. In consequence, variety of structures emerge near the
Galactic centre and bow shocks that are closely studied in this work represent an example of them. The introductory part of this thesis is a brief review of the history of the Galactic centre research and its discovery in radio wavelengths. The main body of the thesis is focused on a simplified model of the bow-shock structures that are generated by stars moving supersonically with respect to the ambient medium. We discuss how these structures vary along the orbit. To this end, we consider four different models: (a) without the presence of any gaseous medium emerging from or accreting onto the SMBH, (b) taking an outflow from the SMBH into account, (c) the case of an inflow onto the SMBH, and finally (d) the combined model involving both an outflow and an inflow at the same time. We discuss symmetries of each model (or lack of them) and we find that the model considering the ambient medium at rest appears symmetrical with respect to the pericentre passage. The combined model manifests itself as the most asymmetrical one of them all. We show profiles for the tangential velocity in the shell and the mass surface density of the bow-shock shell along the stellar orbit for all considered models.