The thesis presents novel analytical and semi-analytical algorithms designed for close proximity operations and rendezvous scenarios. The procedures aim to optimize the impulsive control history (in terms of propellant consumption) to transfer a chaser spacecraft from an initial planar relative orbit to a target final orbit within a fixed time interval. Extensive numerical simulations demonstrate that the algorithms can be efficiently applied to fast rephasing scenarios, rarely addressed in the literature. The procedures are also flexible, and when the reconfiguration asks for predominant variations of the size and shape of the planar relative motion, near optimal or optimal propellant consumption can be achieved. Moreover, this thesis investigates extending the applicability of these algorithms. In particular, the benefits of combining in-plane and out-of-plane maneuvers are evaluated, providing theoretical understandings of three-dimensional reconfiguration problems. The algorithms are also evaluated for accuracy and safety, that are essential features for transfer trajectories in close proximity space operations. The first chapter of the thesis presents an introduction, featuring an extensive literature review and outlining the primary objectives of the research. In the second chapter, state representation using both Cartesian coordinates and relative orbital elements is explored, including a comparative analysis of the two. This chapter also derives the equations of relative motion in terms of relative orbital elements. The specific reconfiguration problem addressed in this thesis is described in the third chapter. The fourth chapter details the development of the proposed analytical algorithms for solving the reconfiguration problems, supported by various numerical simulations that assess their optimality, accuracy, and safety. Similarly, the fifth chapter focuses on the development of semi-analytical procedures, along with their validation in terms of optimality, accuracy, and safety. The final chapter concludes the thesis and proposes directions for future research activities.