

The aim of this thesis is to show some mathematical concepts and methods of differential geometry and Lie groups. Subsequently, we try to use these tools in physics. Selection of these two mathematical topics is not random, because these topics are closely related essentials of theoretical physics. The thesis is split into two chapters. Each chapter fulfills one of these aims. In the first chapter we introduce the notion of group, which is further enriched with other notions, like group action or group product. This detailed and smooth process leads us to the introduction of homogeneous space, which is one of the most important notions of Klein geometry. The end of this chapter is devoted to a brief introduction to this attitude to geometry. The second chapter consists of the formulation of physical tasks in the language of differential geometry and afterwards their solution. As the final topic in this thesis we introduce the Jacobi connection, as a more natural option of connection which is implemented to a physical system.