Summary in English

In the hereby doctoral thesis the selected mathematical aspects of maps, modelling the evolution of periodically and quasiclassically perturbed open quantum systems, were presented and some examples of their practical applications in quantum mechanics were shown.

The evolution of open quantum system, i.e. a physical system described by formalism of quantum mechanics which is allowed to interact with its environment, is usually expressed by so called *dynamical map*, i.e. specialized family of linear maps, which do not alter the fundamental mathematical properties of density operator of a system. If the system Hamiltonian is constant in time this family possesses a structure of a topological semigroup, widely known as *quantum dynamical semigroup*. Its infinitesimal generator defines the density operator dynamics in a form of so called *master equation*, which structure is well explored nowadays.

In the case when the system Hamiltonian is some *arbitrary* function of time, the solution of the master equation can be given only formally in general. It turns out, however, that if the time dependence of the Hamiltonian is of *periodic* nature, the solution may be given exactly. The problem of systems with periodic Hamiltonians is well known and exceptionally significant from a point of view of physics – such systems are very common today, mainly due to the laser spectroscopy where the external perturbation, accomplished in a form of monochromatic laser light, is of periodic nature. The main aim of this thesis is to show, how the mathematical methods used widely in the open quantum systems theory, may be employed to describing the evolution of physical systems with external periodic perturbation. Here, the derivation of appropriate master equation (in the Markovian approximation) based on *Floquet theorem*, applicable to ordinary differential equations with periodic coefficients, was presented, Also, the general structure and important mathematical properties of dynamical map implied by the master equation, were demonstrated. The developed calculational methods were then illustrated by a series of examples, including various quantum systems, interacting with one or few reservoirs and subject to strong, monochromatic laser field.