

Abstract

The present Ph.D thesis deals with feedforward (open-loop) control methods, in classical and quasi-classical physical systems like nonlinear oscillators, quantum particles in external electromagnetic field etc. We investigate the special case of fast oscillating control when the time of control period is sufficiently less to compare with the typical time of controlled system behavior (for instance its period of oscillation). We apply mathematical technique specially developed for feedforward control systems such as Lyapunov method and Kapitza averaging.

First we demonstrate that the Lyapunov spectrum of Kapitza averaged systems are sufficiently different from the original spectra of non-controlled plants. That means the description of averaged system in the neighborhood of their fixed points does not describe appropriately the original system behavior. Secondly we apply Kapitza averaging procedure to the original systems to derive the correcting terms in their dynamical equations.

As a result we demonstrate re-design of original dynamical systems by fast changing control periodical force.