

The thesis aims to discuss spontaneous synchronization phenomenon in dynamic systems, which are noticeable all around us (beating heart, synchronization of clapping crowd, flashing of fireflies, synchronized ticking of metronomes). The goal is to describe different approaches in the construction of mathematical models of different systems. Concrete systems studied in the thesis are fireflies under the influence of stimuli and synchronization of two coupled metronomes. Representative of a general model, Kuramoto model, is analyzed and discussed as well. Several numerical solutions to all those models are presented, dependence on initial values is studied and analyzed both quantitatively and qualitatively. Additionally, interactive applications/animations were created in Wolfram Mathematica to provide visual support of solutions and even some insight into these solutions.