The basic feature of multidimensional (nD) systems is that they transmit information in many independent directions. Hence, every system variable, i.e. inputs, outputs and states are multivariate (vector) functions of discrete and/or continuous indeterminates and the system dynamics evolves over all of them. These systems are very similar to spatially distributed systems which are described by partial differential or difference equations (PDE).

One of the particular cases of nD systems are the so-called repetitive processes where one (discrete by definition) indeterminate counts executions, runs, iterations, trials or passes of some operation, and the remaining indeterminate, for temporal systems is running time (continuous or discrete). The first indeterminate is unbounded, when the second belongs to finite and, in most cases constant, time interval. Hence, a dynamics of repetitive process evolve over the strip on the plane.

For systems with spatially temporal dynamics, the executed operations can be described by more than one indeterminate but also within the regular, closed area, as e.g. a rectangle, a disc, a cuboid or a ball.

Repetitive processes have many physical or industrial applications where some operations are cyclic as for a motor, a gantry robot or a robotic manipulator and many others. They can be used also for modeling various processes and objects. One of the so-called algorithmic applications is Iterative Learning Control (ILC), where the fundamental idea is to use available information from both, the previous and the current trial, to improve the tracking performance successively from trial to trial. Hence, there exists the possibility to create, analyze and design successfully ILC schemes in the form of repetitive processes. ILC is a very promising technique, which can lead to very interesting theoretical results. Recently it finds a great interest in research but in industry is not exploited sufficiently yet. One of the aims of this research project is to show possibilities of further industrial applications of ILC.

The aforementioned techniques will be investigated for nonlinear and stochastic systems and also extended to the very important classes of spatially distributed (interconnected) systems. The first represents the spatially variable processes as heat transfer, bar, plate deformations and many others. The second represents complex systems built of many interconnected subsystems realizing an a'priori prescribed goal.

An important issue will be also to build computer methods to realize the project tasks.