

Labs (Virtual Labs)

The basis of mathematical modeling Practicum.

Introduction.

One-dimensional dynamical systems.

- Discrete systems.
- Continuous systems.
- Event-driven dynamical systems.
- *Instruments*: singular (fixed) points.

Two-dimensional dynamical systems.

- Discrete systems.
- Continuous systems.
- *Instruments*: Phase portrait.

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Event-driven dynamical systems.

- Piece-wise continuous functions and hybrid automata.
- *Instruments*: hybrid automata.

Stability of dynamical systems.

- Discrete systems.
- Continuous systems.
- *Instruments*: Linearization, Eigen-values.

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Bifurcation.

- One-dimensional and two-dimensional dynamical systems.
- *Instruments*: Lamerey diagram.

Strange attractors.

- Discrete systems.
- Continuous systems.
- *Instruments*: bifurcation diagram.

Technologies of component modeling practicum

Object-oriented modeling

- Classes
- Inheritance

Component models. Inputs/Outputs

- Control Theory. (Plant+ Controller)
- Control Theory. Controller with hybrid behavior.
- Instruments: Structural matrix, final systems of equations, Jacobi matrix

Component models. Contacts/Flows

- Electricity, Hydraulics
- Circuit element with variable behavior (Diode, for example).
- Instruments: Structural matrix, final systems of equations, Jacobi matrix

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Component models with variable structure.

- Markov chains.
- Electricity, Hydraulics with variable structure
- Instruments: Structural matrix, final systems of equations, Jacobi matrix

Numerical methods

- NAE.
- ODE.
- DAE.

Computer experiments.

- Statistical experiments. Ballistic, queues

Examples_1

Example_2