MATHEMATICAL MODELING, SIMULATION, OPTIMIZATION AND CONTROL IN SCIENCE AND ENGINEERING

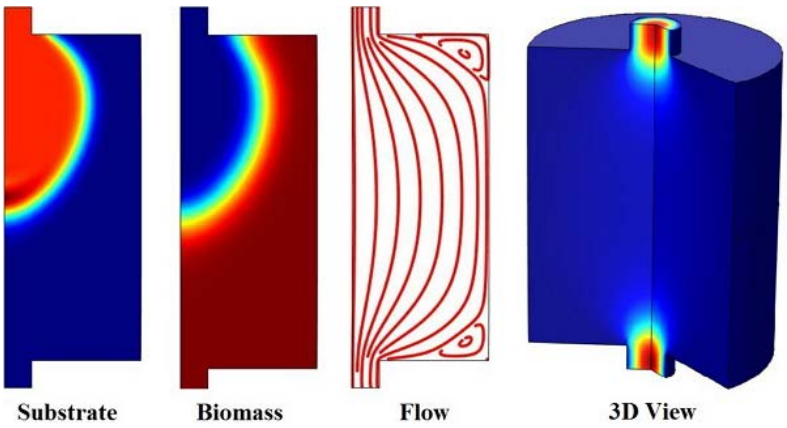
Description

Our group develops and studies mathematical models for the design of prototypes and processes in science and technology. We develop software packages for the required simulation as well.

There are a wide spectrum of fields of interest, like: risk analysis, epidemic propagation, bioreactors, oil spills, lithium batteries, high pressure, image processing, combustion, elasticity, structures, lubrication, new materials, catalysis, homogenization, freezing, climatology, nuclear fusion, etc.

How does it work

1) Modelization with physical laws.
2) Mathematical analysis of the resulting model.
3) Development of a discrete model.
4) Development of an algorithm for obtaining the numerical solution.
5) Implementation in a suitable programming language.
6) Validation of the result with experimental data (if available).
7) Optimization and control.



Simulation of a bioreactor.

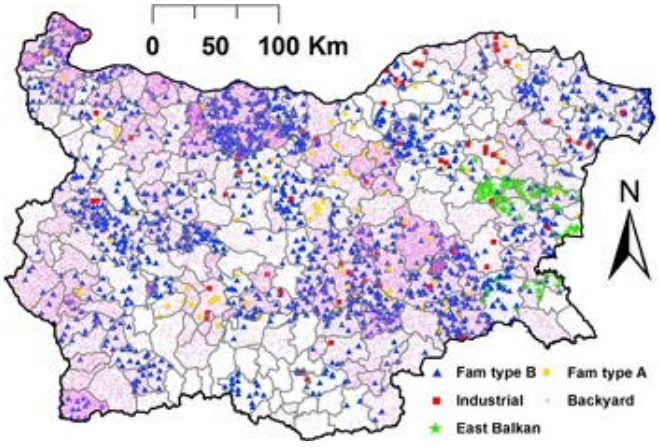
Advantages

Money and time saving in the design of prototypes and in the decision making task for processes of different types.

Money saving: The simulation of the mathematical model allows to avoid many experiment, which are, usually, very expensive.

Time saving: Getting results is usually a very fast process, in contrast with the time needed to obtain data from experiments (when this is affordable).

The use of simulation software allows comparing, in a very short time, potential changes in the design of a prototype or process. Therefore, it can be a very helpful tool for decision making processes, without the need of only relying in the experience and intuition of the responsible team.



Simulation of the development of an Epidemic of Classical Swine Fever in Bulgaria.

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Where has it been developed

The development is made in the research group MOMAT.

Among its main activities we can find: Development of Research projects, software, contracts with companies and agencies.

Research Group MOMAT

Responsible Researcher

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