Dissertation abstract

„Mathematical methods in modeling the diffusion of renewable energy sources"

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The aim of my thesis is to develop mathematical models of binary opinion dynamics that can be used to model the diffusion of photovoltaic panels (or other renewable energy sources), in order to understand how various factors impact this complex process.

Firstly, an already well-established agent-based model of opinion dynamics, the Sznajd model, is studied. The role of the new parameter, allowing for the model's generalization, is evaluated. Next, another well-known model of opinion dynamics, the q-voter model, is analyzed. The impact of the underlying network structure and the method of selecting the group of influence on the time evolution and stationary states is determined.

Then, these models are extended toward modeling the diffusion of innovation, for which opinion dynamics is the key building block. Finally, a new model of eco-innovation diffusion is designed and examined on a multi-layer network structure.

All model are studied via Monte Carlo computer simulations. For the q-voter model and the new model of eco-innovation diffusion, differential equations describing the dynamical systems are derived under certain assumptions. Properties of the dynamical systems, such as stationary states and times to reach them, are determined analytically and numerically.