

Prof. Dr. Dirk Helbing, 20.06.2007

Cascading Disaster Spreading and Optimal, Network-Dependent Response Strategies

The talk presents the study of a disaster model based on cascading failure spreading in different network structures. These networks may represent causality networks or critical infrastructures. As a particular example, blackouts of electrical power grids are discussed. The proposed model considers the redistribution of loads after an initial network failure (triggering event). It is found that neglecting the transient dynamical behavior, as has been done by many publications in the past, dramatically underestimates (by 80-95%) the robustness of the network.

This is due to the transient oscillations or overshooting in the loads, when the flow dynamics adjusts to the new (remaining) network structure.

As a next step, the talk discusses the efficiency of recovery strategies controlling the distribution of resources based on information about the current network state and network topology. In order to assess the success of recovery strategies, a series of simulation experiments was performed.

The considered parameters of these experiments were the network topology, the response time delay and the overall disposition of resources. It turns out that a prompt response and a minimum level of resources are major preconditions for a successful disaster response management.

Curriculum Vitae

Dirk Helbing (*1965, www.helbing.org) is the Managing Director of the Institute for Transport & Economics at Dresden University of Technology, where he was appointed full professor in 2000. Having studied Physics and Mathematics in Göttingen, his master thesis dealt with the nonlinear modelling and multi-agent simulation of observed self-organization phenomena in pedestrian crowds. Two years later, he finished his Ph.D. in Stuttgart on modelling social interaction processes by means of game-theoretical approaches, stochastic methods and complex systems theory, which was awarded two research prizes. After having completed his habilitation on traffic dynamics and optimization in 1996, he received a Heisenberg scholarship. Both theses were printed by international publishers. Apart from this, Helbing has (co-)edited several proceedings of international conferences on cooperative dynamics in socio-economic and traffic systems that he (co-)organized. He has given 150 invited talks and published more than 130 papers, including several contributions to high-impact journals like Nature, Science, or Reviews of Modern Physics, which were discussed by the public media (newspapers, radio, and TV) more than 200 times. He collaborates closely with international scientists, since he worked, for example, at the Weizmann Institute in Israel, the Xerox PARC in the Silicon Valley, and the Collegium Budapest—Institute for Advanced Study in Hungary. Thanks to various multi-partner research projects, he also maintains good cooperations with internationally operating companies like Volkswagen, SCA Packaging, PTV, Infineon Technologies, and others.