ZMATH 2015a.00859

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Large-scale interaction with mathematics.

Nieuw Arch. Wiskd. (5) 15, No. 1, 28-36 (2014).

Johan van Leeuwaarden's "Large-scale interaction with mathematics" constitutes his 2013 inaugural oration as full professor in the section Stochastics of the Department of Mathematics and Computer Science of the Technische Universiteit Eindhoven. This enthusiastic lecture aims at introducing the reader to the applications of mathematics in society and especially to the field of stochastic networks. Network is one of the most popular words of our time; it refers to a set of interconnected entities or persons. Using mathematics allows scholars to understand the behavior of networks and to act upon them, hopefully for the better. How mathematicians try to tame the random variations of networks is explained through a few pedagogical examples. When public switched telephone networks were still difficult to manage, the Danish mathematician Agner Krarup Erlang (1878–1929) was asked to answer the following puzzle: how many telephone lines are needed in order to stabilize the network and to guarantee an acceptable (i.e., prompt) service to the customers? He framed a stochastic model (a simplified mathematical description of the network) to provide a scientific answer. Queuing theory and modelling scaling limits was later resumed by Sir John F. C. Kingman (1939–). Also stock market fluctuations can be interpreted as a Brownian motion of sorts. We now have, mutatis mutandis, the same sort of problem with internet. Of course, communication takes place on a far larger scale, but here as well, we can count on the power of mathematics to cope with stochastic complexity. The same questions occur when the Ministry of Infrastructure and the Environment want to widen ring roads to cope with traffic peaks, or when a wi-fi network needs to be implemented in a large company. (An additional complication of wireless networks is due to the movements of the users.) Scholars furthermore speak of viral information – the difference being of course that a virus should be prevented from spreading whereas the information is designed to be spread fast, thanks, e.g., to social networks. Studying the overwhelming complexity of networks also allow us to assess the potentially life-threatening annual flu epidemic: the contamination process (how quickly and to whom the virus spreads) can be described with the help of a local algorithm The digital revolution has resulted in an explosion of available data. It has never been so urgent to deal with dynamical complexity, so we can celebrate the current trendiness of mathematics: mathematical degrees are becoming increasingly popular in the Netherlands.

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Classification: M45 K35

Keywords: applied mathematics; stochastic; stochastic process; network theory; network