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Erol Gelenbe holds the Dennis Gabor Chair and Heads the Intelligent Systems and Networks Group at Imperial College's EEE Dept. A Fellow of both the IEEE and the ACM, his recent publications span network routing, software defined networks, machine learning, gene regulatory networks, statistical physics, and energy consumption by ICT. He has held chairs in France, Belgium, the USA and now the UK. He graduated over 70 PhDs and made significant contributions to industrial products such as the queueing network analysis software package QNAP, the manufacturing system simulator FLEXSIM, and early voice-packet switches. He founded the "modelling and performance analysis" research activities in France, both at INRIA, CNRS and several universities. In 1996 he was awarded the "Grand Prix France Telecom" of the French Academy of Sciences, and in 2008 he received ACM SIGMETRICS' highest award. Three universities have given him the "doctorate honoris causa": the University of Liege (2006), Bogazici University, Istanbul (2004), and the University of Roma II (1996). In the UK, he has received the Institution of Engineering and Technology Oliver Lodge Medal. Fellow of the Royal Academy of Belgium, the Science Academies of Hungary, Poland and Turkey, and the National Engineering Academy of France, he was awarded Chevalier de la Legion d'Honneur (France) and Commander of Merit (Italy), Officier du Merite (France) and other honours, and received various other awards from IEEE and European organisations.

"Communicating with Spins"

Abstract:
Currently the worldwide electricity consumption by ICT each year is roughly equal to the total amount of electricity consumed annually in Japan. It is still growing significantly each year, while humanity pursues its insatiable need to sense, process data and communicate. Thus we must imagine new low energy physical paradigms that can allow us to compute and communicate and also reduce the energy consumption of ICT, or at least moderate its growth. One possible direction is to encode information into "low level" physical properties of particles, so that a few particles can carry the data units that huge flows of electrons and photons must carry today. This lecture will present a model of spin based communication and its mathematical analysis. We will derive the system's bit error probabilities in the presence of sources of error such as physical imperfections in the medium, quantum entanglement, mutual influence between particles, and random fluctuations, as a function of the amount of energy that such a system may consume. We will suggest a symmetric detection system that can reduce the bit error probabilities, and estimate its characteristics. Finally we will discuss a networked system in which particles with spins traverse multiple sites and influence each other, resulting in both possible errors and their reduction through collective stabilisation.