Noise-based informatics

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Noise-based informatics is a field where the information (sensing, communication, or computation) is carried by the statistical properties of noises (stochastic processes with zero mean), and/or the coincidences of their instantaneous amplitudes with those of reference processes.

Fluctuation-Enhanced Sensing utilizes the statistical processes of the noise in the signal of sensors to serve with extra information about the dynamics of the interaction between the sensor and its environment.

The research on *unconditional security* began with stealth communication (zero-power communications) where the transmitter does not emit energy into the information channel but modulates the inherent noises there. Such system is not necessarily secure. On the other hand, the *Kirchhoff-law-Johnson-noise (KLJN) key exchange* is unconditionally secure and can run in stealth mode, too. It is the classical physical alternative of quantum key distribution.

Noise-based logic (NBL) utilizes a reference system of orthogonal noises to generate the logic signals. Several different NBL types exist. The quantum-mimic system uses the product space of the reference noises, which is a Hilbert space with 2^*N* dimensions where *N* is the number of noise-bits. Recently, "quantum supremacy" has been challenged by NBL.

More details and papers can be found here:

https://noise.ece.tamu.edu/research_files/research_FES.htm
https://noise.ece.tamu.edu/research_files/research_secure.htm
https://noise.ece.tamu.edu/research_files/noise_based_logic.htm

Laszlo B. Kish is a Full Professor at the Department of Electrical and Computer Engineering of Texas A&M University. His main research interests are unidentified problems, and the laws, limits and applications of stochastic fluctuations (noise). The applications include several ones of his own inventions, including: fluctuation-enhanced sensing; noise-based logic and computing; unconditionally secure communications (KLJN); physical communications without emitted signals; unconditionally secure computers, hardware, credit/debit cards and physical unclonable functions (PUF). He was the recipient of the Benzelius Prize of the Royal Society of Science of Sweden (2001); the Doctor of Science (Physics) title from the Hungarian Academy of Science (2001); the Honorary Doctor title from Uppsala University, Sweden (2011); the Honorary Doctor title from University of Szeged, Hungary (2012); the Honorary Professor (2013-2016) and the Distinguished Guest Professor (2015-2018) titles from Hunan University, China; and the Medal of Honor from the Technical University of Gdansk, Poland (2017). Up to now (2018), he has published 236 peer reviewed journal papers; 6 US and 3 Swedish patents; 1 monograph; 17 edited books or proceedings; 67 invited and 94 regular conference papers. He founded the journal Fluctuation and Noise Letters (Editor-in-Chief: 2001-2008; currently: Honorary Editor); the conference series Unsolved Problems of Noise (first Chair: 1996, Szeged); and SPIE's “Fluctuations and Noise Symposium” series (Symposium Chair: 2003 - Santa Fe, 2004 - Canary Islands, and 2005 - Austin, TX). He co-created and co-chaired the conference "Hot Topics of Physical Informatics (HoTPI)", 2013, Changsha, China.