Technische Universität Berlin
Fakultät IV Elektrotechnik und Informatik
Fachgebiet Regelungssysteme
Leitung: Prof. Dr.-Ing. Jörg Raisch
Sekr. EN 11, Tel. 314-22999

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PD Dr.-Ing. Slawomir Stanczak
Technische Universität Berlin
&
Fraunhofer Heinrich Hertz Institut, Berlin

"On Decentralized Detection in Wireless Sensor Networks"

Extensively used in the past for military applications, wireless sensor networks are now becoming increasingly popular in a variety of civilian scenarios, such as factory lines, home and industrial automation, agriculture, automotive electronics, and many others, in a way bridging physical and virtual world and building cyber-physical systems. Wireless sensor networks can be used for detecting malicious attacks or faulty states (e.g. in industrial environments for detecting malfunctions in production processes). Reliable detection of such anomalies is a key ingredient in the development of efficient proactive and reactive defense or repair mechanisms.

Wireless sensor networks have numerous advantages over wired counterparts. They can operate without any fixed infrastructure so that they can be easily deployed and tailored to specific applications. Due to the distributed nature and self-organization capabilities, wireless sensor networks are highly robust and can quickly respond to link failures by reconfiguring and compensating the failing links. They are fault-tolerant and are able to take measurements at many points. Wireless sensor networks can be deployed at almost any location. Wireless sensor network solutions need to take into account the unique features and limitation of these systems: unreliable or inaccurate information due to transmission errors, scarce available wireless and energy resources. This talks presents promising decentralized approaches to detection in wireless sensor networks. We show that many solutions that are optimal in some statistical sense can be posed as the computation of functions, typically weighted averages, where the argument is dispersed throughout the network. In light of this observation, to compute efficiently functions in a network, we study iterative algorithms and review acceleration techniques to compute functions with a paradigm that merges the processes of computation and communication.