CYBER-PHYSICAL SYSTEMS IN ELECTROCHEMICAL MEASUREMENTS.

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The term 'cyber-physical systems' (CPS) refers to integration of computation with physical processes [1]. Usually, the term used to describe embedded systems as well as networks monitoring and controlling physical processes which, through feedback circuits, can affect computation flows. They combine cyber capabilities (communication, computation and control) with physical capabilities (sensing and actuation) to solve problems that neither part could solve alone. Physical processes are compositions of many parallel processes. Hence, CPS are intrinsically concurrent. CPS are multi-dynamical ones: mathematical models laying in their foundations are compositions of multiple elementary dynamical aspects. CPS produce computer control decisions and are, thus, discrete. At the same time they are continuous, because they are based on differential equations of motion or other physical processes. CPS are uncertain, because their behavior is subject to choices coming from environmental variability or intentional uncertainties that simplify their model. This uncertainty can manifest in different ways [2]. Uncertainties make CPS stochastic when good information about the distribution of choices is available. Uncertainties make CPS nondeterministic when no commitment about the resolution of choices is made. Uncertainties make CPS adversarial when they involve multiple agents with potentially conflicting goals or even active competition.

Huge potential of cyber-physical approach to design of modern computer systems is indicated by its fast expansion into new domains of application. Now they include health care, transportation, process control, large-scale infrastructure, defense systems, tele-physical operations and others. Such approach seems to be very effective in solving problems arising in the field of electrochemical measurements as well.

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Analysis shows that even speaking about voltammetry only one can obtain reliable data and make adequate decisions when cyber-physical system is at work. Measurements connected tightly environment, computation and communication; the whole system is multi-dynamic, with feedback interaction between 'cyber' and 'physical' parts; volume of data to be processed is unlimited in many cases.

References

1. Lee E.A. and Seshia S.A. Introduction to Embedded Systems - A Cyber-Physical Systems Approach, http://LeeSeshia.org, ISBN 978-0-557-70857-4, 2011.

2. Platzer A. Logic & Proofs for Cyber-Physical Systems.//N. Olivetti and A. Tiwari (Eds.): IJCAR 2016, LNAI 9706, pp. 15-21, 2016. DOI: 10.1007/978-3-319-40229-1_3

3. Encyclopedia of electrochemistry //A.J. Bard and M. Stratmann eds, vol 3: instrumentation and electroanalytical chemistry (P.R. Unwin ed). WILEY-VCH, Weinheim 2003, 679 + X p. 349 €; ISBN 3-527-30395-2