

Development of a Cyber-Physical Systems Enterprise Architecture based on Sensing Systems

Habilitation Domain: Systems Engineering

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Summary

In the last decade there has been a considerable interest within the international academic society in the development and implementation of Cyber-Physical Systems in multiple domains. On the other hand, Sensing Systems are expected to be a long term solution for Cyber-Physical Systems, as they represent the most important component of a Cyber-Physical Systems. Thus, the main subject of this habilitation thesis is related to the development of a Cyber-Physical Systems Enterprise Architecture based on Sensing Systems.

The scientific results presented in this thesis are related to the presentation of the Cyber-Physical Systems concept, the introduction of the Intelligent Cyber-Enterprise concept, identifying the correlation between Internet of Things and Cyber-Physical Systems, as well as to present the concepts of Sensing Systems, Sensing Enterprise and to define the architecture of a Sensing System. All these concepts are supported by eight case studies that have been published in different top ranked journals or conference proceedings. The publications that summarize my achievements contain either theoretical or experimental results regarding: modelling and implementation of an automated process recognition architecture for Cyber-Physical Systems, definition and implementation of an automated process model generation framework, modelling and implementation of a Cyber-Physical System oriented redundant network node, modelling and implementation of a Cyber-Intelligent Enterprise System, modelling and implementation of a Cyber-Physical Systems oriented transaction platform, modelling of an Enterprise Sensing System Architecture, development of the Future Internet based Enterprise in the context of Cyber-Physical Systems or the development of a Smart Farm as an Intelligent Cyber-Agricultural System.

The habilitation thesis presents the scientific, professional and academic achievements of my career as a member of the Automatic Control and Systems Engineering Department, Faculty of Automatic Control and Computers, University Politehnica of Bucharest, after I finished my PhD studies, between 2011 and 2019. All the scientific activity has been carried out within the research group coordinated by Academician Ioan Dumitrache. During this period, I have been involved in numerous research projects either as participant or coordinator, as well as in three COST actions as Management Committee member that helped me to expand international collaborations and thus, led to the my professional maturity. Also, I enlarged my collaboration horizon both at national and international level involving partners from academia, research institutes and industry. Being involved in various collaborations I had the opportunity to be in contact with the newest researches in the Systems Engineering domain.

The results achieved have been disseminated in 4 papers published in International Journals ranked Q1/Q2 by Clarivate Analytics/ Thomson Reuters Web of Knowledge (ISI) and in 9 papers published in International Journals with impact factor indexed by Clarivate Analytics/ Thomson Reuters Web of Knowledge (ISI), as well as in 28 papers published in proceedings of international conferences indexed Clarivate Analytics / Thomson Reuters Web of Knowledge (ISI) and in 31 papers published in proceedings of international conferences indexed in recognized international databases. I have contributed to the writing

of different books, chapters and textbooks for students and I have been editor or program committee member for 27 journals and conferences. Participating in top conferences gave me the opportunity to exchange ideas, listen to top researches and to interact with many people. The involvement in various research projects had led to the elaboration and submission of one patent and to receiving various scientific awards.

Regarding academic activities, I had the opportunity to participate in the elaboration of new master programs (e.g. Cyber-Physical Systems master program within the Faculty of Automatic Control and Computers) and to introduce new bachelor and master courses. Based on the collaboration and interaction with students, I can say that students related activities represent some of the most important academic activities of a professor as the main purpose of a professor is to make students understand different concepts (such as systems engineering), to guide them and to offer them all the support in their research and academic activities.

As a conclusion, I hope that the scientific collaborations I have, academic achievements and the research topics that I have chosen will lead to my continuous development during my entire academic career.