Stefano Vitturi – Full CV

I. Education and Professional Experience

- Stefano Vitturi graduated (summa cum laude) in Electronics Engineering at the University of Padova (Italy) in 1984.
- In 1986 he became a researcher of the National Research Council of Italy (CNR), Institute for Gas Ionization (IGI), where he has worked for about 15 years at the RFX Project (www.igi.cnr.it), a nuclear fusion experiment built in Padova and currently in operation. His activities were mainly concerned with the control and data acquisition system of RFX.
- In 1993 Stefano Vitturi was appointed as the leader of the Automation and Informatics group of the RFX project. From 1999 to 2000 he temporarily moved to the "Galileo Scientific Park", a technological transfer institution located in Padova, where he coordinated research as well as industrial activities.
- At the end of 2000 he returned to CNR, Institute of Dynamic Systems and Bioengineering (CNR-LADSEB).
- At the end of 2001 Stefano Vitturi was elevated to the grade of CNR Senior Researcher.
- In 2003, following an in–depth reorganization of the CNR scientific network, Stefano Vitturi joined the Institute of Electronics and Computer and Telecommunications Engineering (IEIIT) of CNR, where he founded the Padova territorial site, located at the Department of Information Engineering, University of Padova. He is, currently, the responsible of the IEIIT Padova territorial site which comprises five researchers.

II. Research Activities

The research activities of Stefano Vitturi have been taking place over two different periods. The first one, which focused on industrial control and automation systems, has taken place from 1986 to approximately 1998. In the second period, from 1999 to present, activities are concerned with industrial communication networks.

A. Industrial Control and Automation Systems

In the first period of activity, Stefano Vitturi has worked at the design and implementation of the control, monitoring and data acquisition system, called SIGMA, of RFX (Reverse Field eXperiment), a nuclear fusion experiment currently in operation in Padova, Italy. The main topics he addressed were concerned with:

- Industrial control and automation systems based on Programmable Logic Controllers (PLCs) and real-time communication networks;
- Data acquisition systems of large physics experiments.

A first working version of SIGMA was available at the end of 1991, when the RFX operation started. In the subsequent years, the activities of Stefano Vitturi at RFX focused on the completion of SIGMA as well as on the handling of the RFX experiments.

The most important achievement obtained in this context has been the full and satisfactory implementation of SIGMA, that was reached indicatively at the end of 1993, when the more critical physics diagnostic subsystems (for machine operation) were completely integrated in SIGMA. Also, the data acquisition system of RFX (which is called MDS/Plus and is part of SIGMA), that was developed in collaboration with MIT, has been adopted by several different nuclear fusion experiments all over the world. The most important features of SIGMA are outlined as follows:

- Number of subsystem PLCs (i.e. powerful PLCs that handle a whole machine subsystem): $\sim$ 9;
- Total number of PLCs: $\sim$ 80;
- Number of "slow" I/O signals (i.e. signals of industrial type handled by PLCs): $\sim$ 5,000;
- Number of "fast" I/O signals (i.e. signals used by the timing system and diagnostic experiments): $\sim$ 400;

More information about RFX and SIGMA can be found at the following address: http://www.igi.cnr.it/

B. Industrial Communication Networks

The research activities on industrial communication networks started approximately in 1995 and were triggered by the experience gained in the design and implementation of SIGMA. The first networks addressed were the fieldbuses, that are communication systems specifically conceived for industrial applications. The main activities of Stefano Vitturi in this context have been concerned with:

- protocol design;
- performance analysis;
- implementation of fieldbus interfaces for devices like sensors/actuators;
- international/national standardization.

Two fieldbuses have been mainly addressed, namely Profibus and Controller Area Network (CAN). For both these networks, the work carried out by Stefano Vitturi was aimed at investigating their performance as well as to propose enhancements to the protocols.

A second type of industrial communication systems has been studied by Stefano Vitturi since the beginning of 2000. These are commonly referred to as Real-Time (or Industrial) Ethernet networks and, basically, they represent the natural evolution of the fieldbuses, in that they make use of the well known Ethernet technology to achieve better performance. The networks specifically addressed by Stefano Vitturi in this context were Ethernet Powerlink, Profinet, Ethernet/IP and Modbus TCP. Similarly to the activities relevant to the fieldbus, also in this case performance analyses, as well as protocol assessment, design and modifications were carried out.

Since 2003, approximately, Stefano Vitturi began to address wireless communication systems for industrial real-time applications. In his activities, Stefano Vitturi addressed mainly three networks, namely Bluetooth, IEEE 802.15.4 and IEEE 802.11. Particularly, both IEEE 802.15.4 and 802.11 were subjected to exhaustive analyses carried out via theoretical models, simulations and practical assessments on prototype network installations. The analyses executed on these networks were mainly aimed at assessing their suitability for industrial real–time communication. Indeed, as it is well known, the wireless communication is implicitly error prone and, moreover, the random delays often introduced by the medium access strategies contribute to increase the uncertainty on packet delivery. This, clearly, may have a negative impact on the applications that use this type of networks. However, it has been demonstrated that a careful tuning of the network parameters as well as the adoption of rate adaptation techniques may allow to obtain performance figures that may be comparable with those of the wired counterparts.

III. Conference Organization

Stefano Vitturi has served as program chair, track chair and member of the program committee of several conferences. The most significant ones are the following.

- IEEE Conference on Emerging Technologies and Factory Automation (ETFA)
  - Program co-chair of the "Industrial Communication Systems" track for the years: 2008, 2009 and 2010
  - Program co-chair of the "Work in Progress Session in 2005
  - Member of the program committee for the years: 2011, 2012, 2013, 2014, 2015, 2016 and 2018
- IEEE Workshop on Factory Communication Systems (WFCS)
  - Co-chair of the "Industry day and panel discussion" in 2006
  - Program co-chair of the "Work in Progress Session" in 2010
  - Member of the program committee for the years: 2008, 2012 and 2014
- IEEE World Conference on Factory Communication Systems (WFCS)
  - Program co-chair in 2015
  - Member of the program committee for the year 2016
- IFAC Conference on fieldbus and networks in industrial and embedded systems (FET)
  - Member of the program committee for the years 2007 and 2009
- IEEE Conference on Industrial Informatics (INDIN)
  - Member of the program committee for the years 2017 and 2018
- IEEE Conference on Industrial Technology (ICIT)
  - Member of the program committee for the year 2017

IV. Editorial Activity

A. Associate Editor

Stefano Vitturi is serving as Associate Editor for the following journals

- IEEE Transactions on Industrial Informatics since 2016
- Journal of Electrical and Computer Engineering, Hindawi Publishing Company since 2017

He has served as Associate Editor for the International Scholarly Research Notice Computer Engineering, Hindawi Publishing Company from 2010 to 2017.

He is currently serving as Chief Guest Editor for the forthcoming Special Issue on the Proceedings of the IEEE titled: "Real–Time Networks and Protocols for Factory Automation and Process Control Systems".

Stefano Vitturi has served as Co-Guest Editor of three Special Sections appeared on the IEEE Transactions on Industrial Informatics, namely,

- Special Section on "Wireless Technologies in Factory and Industrial Automation", IEEE Transactions on Industrial Informatics, vol. 3 issues 2 and 3, May/August 2007 (other Guest Editors: D. Miorandi, E. Ulhemann and A. Willig)
- Special Section on "Industrial Communication Systems' IEEE Transactions on Industrial Informatics, vol. 6 issue 3, May 2010 (other Guest Editor: J. Proenza).
- Leading Guest Editor of the Special Section on "Communication in Automation", IEEE Transactions on Industrial Informatics, vol. 12 issue 5, October 2016 (other Guest Editors: J. Proenza, P.Pedreiras, T. Sauter).

B. Reviewer Activity

Stefano Vitturi has served as reviewer for the following international journals

- IEEE Transactions on Industrial Informatics
- IEEE Transactions on Industrial Electronics
- IEEE Transactions on Automation Science and Engineering
- IEEE Communication Letters
- International Journal of Systems, Control and Communications (Inderscience)
- Flow Measurement & Instrumentation (Elsevier)
- Computer Communications (Elsevier)
- Networks (Elsevier)
- Computer Standards & Interfaces (Elsevier)
- IET Communications
- IEEE Industrial Elctronic Magazine
- IEEE Systems Journal
- International Journal of Distributed Sensor Networks (Hindawi)
- International Journal of Electronics and Communications (Elsevier)

V. Teaching Activity

Stefano Vitturi has taught several different level university courses as professor under contract. The most significant ones are listed below.

- 2001: "Industrial Communication Networks", University of Padova (Italy), PhD course on Electrical Engineering;
- 2005–2007: "Programmable Logic Controllers and Fieldbuses", Post-degree course on Project Management and System Engineering, University of Udine (Italy);
- 2007: "Application of Petri Nets to the modeling of manufacturing systems", University of Padova (Italy), PhD course on Mechatronics Engineering;
- 2009–2011: "Industrial Communication Networks", University of Padova, Master degree course on Mechatronics Engineering;
- 2011–present: "Industrial Automation", University of Padova (Italy), Master degree course on Automation Engineering;

VI. Tutoring

Stefano Vitturi has been responsible of Master degree thesis for several students at the University of Padova.

He has been serving as tutor of four PhD students of the PhD school on Information Engineering at the University of Padova, namely Lucia Seno (2008 - 2010), Michele Luvisotto (2015 - 2017), Luca Fregonese (2018 – present) and Alberto Morato (2018 – present). He has been responsible of the PostDoc grants funded by CNR-IEIIT for the following PhD: Dr. Giovanni Gamba (2010), Dr. Lucia Seno (2012-2013) and Dr. Federico Tramarin (2012-2013).

VII. Research Projects Coordination

A. International and National Projects

Stefano Vitturi has been the responsible for CNR-IEIIT of the following projects:

- IMPROVE (http://www.eniac-improve.eu/), a project funded by the European Commission in the framework of the ENIAC Joint Technological Initiative. IMPROVE lasted 3.5 years from January 2009 to June 2012 and was aimed to enhance European semiconductor fabs efficiency by providing methods and tools to better control the process variability, reduce the cycle time and enhance the effectiveness of the production equipment. The project involved 36 partners for a total funding of about 18 millions €. CNR–IEIIT was funded with about 369,000.
- "New generation hybrid networks in measurement and industrial automation applications - Characterization and wired/wireless perfomance measurement" a project lasted two years from October 20011 to October 20013, funded by the Italian government in the framework of the national research projects 2009 (PRIN 2009). The total cost of the project was about 335,000 €. CNR–IEIIT was funded with about 45,000 €.
- ADMIN – 4D "ADditive Manufacturing & INdustry 4.0 as innovation Drivers, research project funded by the "Regione Veneto"in the framework of "POR FSR Veneto 2014 – 2020, Asse 1, Azione 1.4 DGR N. 1139", from November 2017 to October 2020. . The total cost of the project is about 1,800,000 €. CNR–IEIIT is funded with about 110,000 €. Stefano Vitturi is also the scientific responsible of the project.

B. Research Projects Funded by Private Industries

Stefano Vitturi has coordinated several research projects established between the National Research Council of Italy and private Italian companies. Here is a list of the most important ones:

- Enerspin (www.enerspin.eu): one project in 2017 – 2018
- MC Electronics (www.mcelettronica.it): one project in 2015
- K-Blue (www.kblue.it): one project in 2015
- Weightpack s.r.l. (www.weightpack.com): four projects in the years 2004, 2007, 2008 and 2009
- Uteco Converting s.p.a. (www.uteco.com): one project in 2009
- SCM-Group (www.scmgroup.com): one project in 2004
- SIPA s.p.a. (www.sipasolutions.com): one project in 2003
- Electrolux Zanussi (www.electroluxzanussi.it): one project in 2000

List of Representative Publications

[1] F. Tramarin, C. Narduzzi, M. Bertocco, and S. Vitturi, "A Calibrated Test-Set for Measurement of Access-Point Time Specifications in Hybrid Wired/Wireless Industrial Communication," *Information (Basel)*, vol. 9, no. 5, 2018.

[2] M. Luvisotto, F. Tramarin, L. Vangelista, and S. Vitturi, "On the Use of LoRaWAN for Indoor Industrial IoT Applications," *Wireless Communications and Mobile Computing*, vol. 2018, p. 11, 2018. [Online]. Available: 10.1155/2018/3982646

[3] M. Luvisotto, F. Tramarin, and S. Vitturi, "A Learning Algorithm for Rate Selection in Real–Time Wireless LANs," *Computer Networks*, vol. 126, no. Supplement C, pp. 114 – 124, 2017.

[4] A. Cenedese, F. Tramarin, and S. Vitturi, "An Energy Efficient Ethernet Strategy Based on Traffic Prediction and Shaping," *IEEE Transactions on Communications*, vol. 65, no. 1, pp. 270–282, Jan 2017.

[5] F. Tramarin, S. Vitturi, M. Luvisotto, and A. Zanella, "On the Use of IEEE 802.11n for Industrial Communications," *IEEE Transactions on Industrial Informatics*, vol. 12, no. 5, pp. 1877–1886, Oct 2016.

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[7] S. Vitturi and F. Tramarin, "Energy Efficient Ethernet for Real–Time Industrial Networks," *Automation Science and Engineering, IEEE Transactions on*, vol. 12, no. 1, pp. 228–237, Jan 2015.

[8] F. Tramarin and S. Vitturi, "Strategies and Services for Energy Efficiency in Real–Time Ethernet Networks," *Industrial Informatics, IEEE Transactions on*, vol. 11, no. 3, pp. 841–852, June 2015.

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[11] L. Seno, F. Tramarin, and S. Vitturi, "Performance of Industrial Communication Systems - Real Application Contexts," *Industrial Electronics Magazine, IEEE*, vol. 6, no. 2, pp. 27–37, June 2012.

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[13] L. Seno, S. Vitturi, and C. Zunino, "Analysis of Ethernet Powerlink Wireless Extensions Based on the IEEE 802.11 WLAN," *Industrial Informatics, IEEE Transactions on*, vol. 5, no. 2, pp. 86–98, May 2009.

[14] G. Cena, L. Seno, A. Valenzano, and S. Vitturi, "Performance Analysis of Ethernet Powerlink Networks for Distributed Control and Automation Systems," *Computer Standards and Interfaces*, vol. 31, no. 3, pp. 566–572, March 2009.

[15] G. Cena, A. Valenzano, and S. Vitturi, "Hybrid Wired/Wireless Networks for Real-Time Industrial Communications," *Industrial Electronics Magazine, IEEE*, vol. 2, no. 1, pp. 8–20, March 2008.

[16] M. Bertocco, G. Gamba, A. Sona, and S. Vitturi, "Experimental Characterization of Industrial Wireless Sensor Networks for Measurement Applications," *IEEE Transactions on Instrumentation and Measurement*, vol. 57, no. 8, pp. 1537–1546, August 2007.

[17] S. Vitturi, I. Carreras, D. Miorandi, L. Schenato, and A. Sona, "Experimental Evaluation of an Industrial Application Layer Protocol over Wireless Systems," *Industrial Informatics, IEEE Transactions on*, vol. 3, no. 7, pp. 275–288, November 2007.

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