

Dr. Silvio Simani

CURRICULUM VITAE

PERSONAL DATA

SURNAME AND NAME	Simani Silvio
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ITALIAN NATIONAL SCIENTIFIC QUALIFICATION (“ASN”)

- **Academic Field:** 09/G1 Automatica
- **Level:** II fascia

WORKING EXPERIENCE

- February 2005 – today. Full time Assistant Professor (Ricercatore “confermato”), Academic Field 09/G1 Automatica, Academic Discipline ING-INF/04 – AUTOMATICA. University of Ferrara, Department of Engineering Via Saragat 1, 44122 Ferrara (FE). Italy
- February 2002 – January 2005. Full time Assistant Professor (Ricercatore “non confermato”), Academic Discipline K04X - Automatica. University of Ferrara, Faculty of Engineering Via Saragat 1, 44122 Ferrara (FE). Italy
- September 2000 – December 2000 & September 2001 – December 2001. Post Doc Research Fellow, Academic Discipline K04X – Automatica. Department of Mathematics & Engineering, The University of Hull, Hull (UK). Main activities and responsibilities: Development and Application of Methods for Actuator Diagnosis in Industrial Control Systems. The research was focused on the development of fault diagnosis technique for the actuators and sensors of an industrial process.
- June 2000 – September 2000. Post Doc Research Fellow. Academic Discipline K04X – Automatica. Main activities and responsibilities: Electronics & Mechanics Collaborative Project. Development of automatic software tools for the detection and isolation of faults in gas turbines.
- October 1999 – June 2000 & January 2001 – September 2001. Part Time Assistant Lecturer, Academic field K04X – Automatica. University of Ferrara, Faculty of Engineering, Via Saragat 1, 44122 Ferrara (FE). Italy. Main activities and responsibilities: Assistant lecturer for the courses of Automatic Control and Automatic Control Laboratory, with the supervision of Prof. Sergio Beghelli.

EDUCATION AND TRAINING

- March 2000. Ph.D. at the University of Modena and Reggio Emilia, Modena, Italy.
- June 1996. Master of Science's Degree (laurea). Faculty of Engineering, University of Ferrara. Italy

RESEARCH ACTIVITY

The research activities developed by Dr. Silvio Simani are mainly oriented to problems regarding the supervision, diagnosis and fault tolerant control for dynamic systems, as well as the modelling and identification for dynamic processes. These research topics present both theoretical and application characteristics, which can be structured as follows:

- *Modelling, Identification of Dynamic Systems.* This topic concerns the study of methodologies and tools for the modelling and the identification of nonlinear dynamic systems by means of:
 - affine or piecewise linear prototypes;
 - fuzzy models
 - neural networks;

These models are oriented to the design of an output predictor for the model under investigation, which should allow the detection and the isolation of faults regarding actuator, components, and sensors of dynamic processes.

- *Supervision, fault diagnosis, and fault tolerant control for dynamic systems.* These research issues have been oriented to the synthesis of algorithms for the fault diagnosis, detection, isolation, and controller accommodation with application to dynamic processes. These techniques, developed from the analytic redundancy principle, have been based on:
 - linear or hybrid models identified using the data acquired from the process under diagnosis;
 - state, output observers, Kalman filters, particle filters;
 - neural networks and nonlinear adaptive filters for the fault function identification;
 - residual generators designed via polynomial methods, nonlinear geometric approach, which allow the optimisation of the fault sensitivity and the minimisation of the uncertainty effects;
 - nonlinear tools for the design of nonlinear residual generators or fault function nonlinear approximators (nonlinear geometric approach and adaptive filtering);
 - hybrid models;

these tools have been designed and applied to different systems:

- industrial gas turbines;
- civil aerial vehicles, and UAS (Unmanned Aerial Systems);
- aerospace systems;
- industrial and power processes;
- chemical reactors;
- manufacturing systems;
- wind turbines.

1. Scientific Activity

- 1.1 *The main research activities are reported below, with reference to the selected bibliographical references, followed by the evidence that the presented results are original, significant and due to the determining, prevailing and clearly recognizable contribution of Dr. Simani; it is also highlighted that they have been widely spread and have obtained outstanding recognitions by the international scientific community; moreover, they qualify the candidate as a distinguished international expert in his own field, regarding advanced control, fault diagnosis and fault tolerant control for power plants, energy conversion systems, aircraft and spacecraft systems.*

Regarding the first research issue of the *Identification and Fault Diagnosis of Simulated Processes, with application to gas turbine*, were motivated by the challenge of developing

diagnostic tools for a gas turbine prototype (developed by ABB Alstom UK in 1999) to indicate the onset of developing faults and provide a mechanism for predictive maintenance requirements, as described in [58]. Although the gas turbine is a complex dynamical system, Dr. Simani with his researches showed that the proposed model-based approach to fault detection and isolation could work very well also for nonlinear systems under realistic fault conditions. Two main aspects of the proposed methodology should be underlined, which represent the main contributions brought by Dr. Simani expertise. Firstly, the system complexity does not indicate a requirement for a complex physical or thermodynamic model. This is because system identification methods, as suggested by Dr. Simani are exploited, thus obviating the requirement for physical models. Secondly, Dr. Simani in his studies proposed to exploit linear prototypes for the design of linear output estimators instead of using complicated nonlinear models. Nonlinear modelling is far from a straightforward subject, even if there is a steady increase in research in this subject. Regardless of the surge in interest in nonlinear systems, as suggested by Dr. Simani, the linear approach to fault diagnosis is still advantageous in terms of solution complexity and performance. This is especially true if so-called robust solutions are sought, where the robustness is used to minimize the effects of modelling errors, thus highlighting the main contribution brought by Dr. Simani. This aspect is also fundamental when the proposed strategies require proper certification and validation procedures when they will work under customer operation.

On the other hand, this scientific activity (see e.g. [58]) summarises the research project and technology transfer regarding the fault diagnosis and supervision of industrial and power systems started in 1998 during Dr. Simani's Ph.D. studies under the supervision of Prof. Ron J. Patton of the Hull University. In fact, the investigated research topics involved Universities such as the Control and Intelligent Systems Engineering Department, University of Hull, UK (coordinator Prof. Ron J. Patton) and The Department of Electronic & Electrical Engineering (EEE), University of Strathclyde, Glasgow, Scotland (coordinator Prof. Mike J. Grimble), and the ABB Alstom UK, who developed the gas turbine prototype in 1998. During this cooperation, the research developed by Dr. Simani addressed the development of identification strategies oriented to the design of control and diagnosis schemes in the presence of disturbance, uncertainty and errors. These methodologies have been also applied to power systems, chemical processes, and industrial plants, as shown in [30]. Moreover, the same identification techniques presented in [58] were successfully applied also to aircraft and aerospace systems, as shown e.g. in [88], [89] and [100], and allowed for the successful cooperation and technology transfer project with the University of Hull (UK, Prof Ron J. Patton), EADS - Astrium ESTEC (Toulouse, France, Dr. Bernard Polle) and ESA (European Aerospace Agency, Holland, Dr. Denis Fertin) with the title: "Robust Estimation for Failure Detection", Ref: EAA.TCN.89079.ASTR. In this case, the main aim of the project, which represents also the most important contribution by Dr. Simani, was the development of a supervision module, designed on the basis of suitable identified models, with application to an aerospace system, i.e. the MARS EXPRESS satellite model, in the presence of uncertainty and disturbance.

On the other hand, concerning the second research issue of the *fault diagnosis and fault tolerant control for wind turbines* (see e.g. [130, 147]), they present the important results achieved by Dr. Simani and regarding the development of fault diagnosis and fault tolerant control schemes for wind turbine systems. These solutions, which are also the main contribution brought by Dr. Simani in this field, represent key issues particularly important when applied to offshore wind turbine installations, where operation and management activities highly affect the final cost of the produced electric energy. Therefore, Dr. Simani addressed the development of reliable, effective and viable procedures for the supervision and the control of these complex energy conversion systems, which allow for their proper working conditions even in case of severe malfunctions, and before the planned maintenance operations can take place.

The results presented in these works [130, 147] were also successfully applied to the considered wind turbine benchmark, as demonstrated by the awards and prizes received for the best software solutions to the fault diagnosis problem developed by Dr. Simani in the "Competition on Fault Detection and Fault Tolerant Control for Wind Turbines". This award was sponsored by kk-electronic a/s (Denmark) and MathWorks (USA), during the 18th IFAC World Congress, August 29 to September 2, 2011, Milano, Italy. Dr. Simani was awarded the 3rd place for the best software solution to the FTC problem in the "Competition on Fault Detection and Fault Tolerant Control for Wind Turbines". Award sponsored by kk-electronic a/s (Denmark) and MathWorks (USA) during the 8th SAFEPROCESS, IFAC International Symposium on Fault Detection, Supervision and Safety for Technical Processes. Mexico City, Mexico, 29 - 31 August 2012 and the 3rd place award during the IFAC World Congress in Cape Town, South Africa, 24–29 August 2014. These awards and prizes are described in Sections 2.3, 2.4 and 3.4.

1.2 List of the selected 15 publications. For each publication and/or set of publications, a brief description of Dr. Simani's contribution, their scientific/technical significance and individual importance, and the overall impact of the results in the international scientific community are reported.

- [58] S. Simani, "Identification and Fault Diagnosis of a Simulated Model of an Industrial Gas Turbine," *IEEE Transactions on Industrial Informatics*, vol. 1, pp. 202–216, August 2005. DOI: 10.1109/TII.2005.844425.
- [73] S. Simani, "Fault Diagnosis of a Simulated Industrial Gas Turbine via Identification Approach," *International Journal of Adaptive Control and Signal Processing*, vol. 21, pp. 326–353, May 2007. Copyright 2006 John Wiley & Sons, Ltd. ISSN: 0890–6327. DOI: 10.1002/acs.924.
- [88] S. Simani and R. J. Patton, "Fault diagnosis of an industrial gas turbine prototype using a system identification approach," *Control Engineering Practice*, vol. 16, pp. 769–786, July 2008. Publisher: Elsevier Science. ISSN: 0967–0661. DOI: 10.1016/j.conengprac.2007.08.009.
- [120] H. A. Nozari, M. A. Shoorehdeli, S. Simani, and H. D. Banadaki, "Model-based Robust Fault Detection and Isolation of an Industrial Gas Turbine Prototype Using Soft Computing Techniques," *Neurocomputing*, vol. 91, pp. 29–47, March 2012. ISSN: 0925–2312. DOI: 10.1016/j.neucom.2012.02.014. PII: S0925231212001580.

The references [58], [73], [88] and [120] present the results regarding the development of a fault diagnosis scheme applied to a gas turbine benchmark. The investigations started in 1998 during the visit of Dr. Simani at the University of Hull during his Ph.D. studies, also within the Network: EC FP5 Research Training Network DAMADICS, "Development and Application of Methods for Actuator Diagnosis in Industrial Control Systems", Contract Number: HPRN-CT-2000-00110. Network Co-ordinator: Prof. Ron J. Patton; host institution: School of Engineering, University of Hull (UK). Moreover, this cooperation continued also during the post-doc research contract and technology transfer project, with coordinator Prof. R. J. Patton from the University of Hull. In particular, as described in [58], [73], [88], the main research issue proposed by Dr. Simani, which represents also the most important contribution to the investigated topic, was focussed on the development and the application of methods for fault diagnosis in an industrial process, such as the wind turbine system. The main point of the papers [58], [73], [88] consists of exploiting an identification scheme in connection with dynamic observer or filter design procedures for diagnostic purposes. Thus, black-box modelling and output estimation approaches to fault diagnosis are in particular advantageous in terms of solution complexity and performance achieved. Moreover, the suggested scheme is especially useful when robust solutions are considered for minimising the effects of modelling errors and noise, while maximising fault sensitivity. In order to experimentally verify the robustness of the solution obtained, the proposed FDI strategy has been applied to the simulation data of a single-

shaft industrial gas turbine plant in the presence of measurement and modelling errors. Hence, extensive simulations of the test-bed process and Monte Carlo analysis are the tools for assessing experimentally the capabilities of the developed FDI scheme, when compared also with different data-driven diagnosis methods. In particular, the paper [120] investigates a model-based robust fault detection and isolation method with hybrid structure, relying on a bank of time-delay multilayer perceptron models, which are exploited as residual generators. The residual evaluation is developed with a passive approach based on model error modelling to achieve the threshold adaptation. Also in [120], brief comparative studies with related works done on the same gas turbine benchmark are also provided to show pros and cons of the presented approach. Finally, the development and the implementation of the model-based approaches for fault diagnosis that exploit dynamic system identification strategies represent the main contribution proposed by Dr. Simani.

- [64] M. Bonfè, P. Castaldi, W. Geri, and S. Simani, "Fault Detection and Isolation for On-Board Sensors of a General Aviation Aircraft," *International Journal of Adaptive Control and Signal Processing*, vol. 20, pp. 381–408, October 2006. Copyright 2006 John Wiley & Sons, Ltd. ISSN: 0890-6327. DOI: 10.1002/acs.906.
- [101] P. Castaldi, W. Geri, M. Bonfè, S. Simani, and M. Benini, "Design of residual generators and adaptive filters for the FDI of aircraft model sensors," *Control Engineering Practice*, vol. 18, pp. 449–459, May 2010. ACA'07 – 17th IFAC Symposium on Automatic Control in Aerospace Special Issue. Publisher: Elsevier Science. ISSN: 0967-0661. DOI: 10.1016/j.conengprac.2008.11.006.
- [127] P. Baldi, P. Castaldi, N. Mimmo, and S. Simani, "A New Aerodynamic Decoupled Frequential FDIR Methodology for Satellite Actuator Faults," *International Journal of Adaptive Control and Signal Processing*, vol. 28, pp. 812–832, Sept. 2014. Invited Paper for the Special Issue on "Emerging Trends in Active Methods for Fault Tolerant Control". John Wiley & Sons, Ltd. ISSN: 0890-6327. DOI: 10.1002/acs.2379.
- [140] P. Castaldi, N. Mimmo, and S. Simani, "Differential Geometry Based Active Fault Tolerant Control for Aircraft," *Control Engineering Practice*, vol. 32, pp. 227–235, Oct. 2014. Invited Paper. DOI:10.1016/j.conengprac.2013.12.011.

The studies addressed in the references [64], [101], [127] and [140] followed the results achieved from the national project PRIN 2008 (Project of National Interest funded by the Italian Ministry of University and Research, 2008 – 2012): Title: "Development of a technological demonstrator of a CUAV (Civil Unmanned Aerial Vehicle) for testing novel guidance and fault tolerant control schemes for patrolling and rescue missions in harsh environment", whose local coordinator was Dr. Simani, and national coordinator Prof. Paolo Castaldi. In particular, the work [64] proposed the development of a fault diagnosis scheme, applied to aircraft model, which represents the main contribution proposed by Dr. Simani. The approach was modified in [101] order to provide an estimation of the fault signal, which can be exploited for the implementation of fault tolerant schemes, as described in [127] and [140]. These works showed how to derive adaptive filters with disturbance decoupling features for fault identification. On the other hand, the fault diagnosis scheme can be based also on polynomial methods, which exploits a disturbance decoupling technique in connection with a linear dynamic filter design procedure. Moreover, in order to analyse the robustness and reliability properties of the two schemes, extensive simulations are performed in the presence of turbulence, measurement noise and modelling errors. The optimisation of the linear fault diagnosis methodologies and the analysis of the achieved performance represent the main contribution provided by Dr. Simani.

- [106] M. Bonfè, P. Castaldi, N. Mimmo, and S. Simani, "Active Fault Tolerant Control of Nonlinear Systems: The Cart-Pole Example," *International Journal of Applied Mathematics and Computer Science – AMCS*, vol. 21, pp. 441–455, Sept. 2011. Special Issue: "Issues in Fault-Tolerant Control and Fault Diagnosis". Organisers: Puig, V. and Witczak, M.. ISSN: 1641-876X. DOI: 10.2478/v10006-011-0033-y.

The reference [106] presents in a tutorial way the design of fault diagnosis and active fault tolerant control schemes that can be developed for nonlinear systems. The methodology is based on a fault

detection and diagnosis procedure relying on adaptive filters designed via the nonlinear geometric approach, which allows obtaining the disturbance decoupling property. The controller reconfiguration exploits directly the on-line estimate of the fault signal. The classical model of an inverted pendulum on a cart is considered as an application example, in order to highlight the complete design procedure, including the mathematical aspects of the nonlinear disturbance decoupling method based on the nonlinear differential geometry, as well as the feasibility and efficiency of the proposed approach. Extensive simulations of the benchmark process and Monte Carlo analysis are practical tools for assessing experimentally the robustness and stability properties of the developed fault tolerant control scheme, in the presence of modelling and measurement errors. The main contribution of Dr. Simani consists of the implementation and the analysis of the proposed methodology, with application to the considered benchmark. These design and simulation tools developed by Dr. Simani highlight that the proposed strategy can constitute a reliable and robust approach for application to real nonlinear processes.

- [100] R. J. Patton, F. J. Uppal, S. Simani, and B. Polle, "Robust FDI applied to thruster faults of a satellite system," *Control Engineering Practice*, vol. 18, pp. 1093–1109, September 2010. ACA'07 – 17th IFAC Symposium on Automatic Control in Aerospace Special Issue. Publisher: Elsevier Science. ISSN: 0967–0661. DOI: 10.1016/j.conengprac.2009.04.011.

The reference [100] summarised the main achievements obtained from the Cooperation and technology transfer project with the University of Hull (UK, Prof Ron J. Patton), EADS - Astrium ESTEC (Toulouse, France, Dr. Bernard Polle) and ESA (European Aerospace Agency, Holland, Dr. Denis Fertin) with the title: "Robust Estimation for Failure Detection", Ref: EAA.TCN.89079.ASTR. The main aim of the project was the development of a supervision module with application to the aerospace system. The system under investigation consisted of the MARS EXPRESS satellite model, which represents a distributed system, in the presence of uncertainty and disturbance. In particular, the main point was the design of a comprehensive methodology that allows the supervision, the fault detection and isolation of the gyroscopes and thrusters of the Mars Express Satellite. The main contribution proposed by Dr. Simani consists of the derivation of a robust approach to fault diagnosis for the development of residual generator applied to the satellite system. The approach suggested by Dr. Simani is based on both state estimation of an accurate linear model for the satellite system and the design of an unknown input decoupling to achieve robust fault diagnosis in the presence of severe dynamic uncertainty during main engine deployment. The same scheme applied to the satellite systems were already exploited for the gas turbine process, as described in the works [58], [73] and [88].

- [129] S. Simani, "Residual Generator Fuzzy Identification for Automotive Diesel Engine Fault Diagnosis," *International Journal of Applied Mathematics and Computer Science – AMCS*, vol. 23, pp. 419–438, June 2013. Invited Contribution to the AMCS Quarterly. Organisers: Koscielny, M. J. and Syfert, M. ISSN: 1641–876X. DOI: 10.2478/amcs–2013–0032.

The reference [129] summarised the results achieved from the Technology Transfer Project (2006 - 2012) entitled: "Towards the virtual motor thermal-fluid-dynamic modelling of advanced diesel engines via software tools, practical experiments, and test rigs" (application nr. DM28633, Art.12EMec). The project concerned the modelling the diesel engine subsystems, together with the design of the control strategies of the Electronic Control Unit. The design is oriented to the reduction of both the fuel consumptions and the pollution emissions. Cooperation among Consorzio Ferrara Ricerche (CFR), the Department of Engineering of the University of Ferrara (scientific coordinator Dr. Simani), and the local company VM Motors S.p.A, Cento (FE), Italy. The work [129] showed the successful contribution and the effective methodology proposed by Dr. Simani, which is based on a fuzzy modelling approach oriented to the design of a fuzzy controller for regulating the fresh airflow of a real diesel engine. Dr. Simani has suggested this strategy described in [98] for enhancing the regulator design that could represent an alternative to the standard embedded BOSCH controller, already implemented in the Engine Control Unit (ECU), without any change to the engine instrumentation. Again the contribution proposed by Dr. Simani consists of the development of a fuzzy modelling and identification scheme, which is able to provide a high-fidelity reconstruction of the controlled signals. Another advantage of the procedure suggested Dr. Simani is that the proposed scheme is more straightforward and easier to implement than different strategies

proposed in literature. A modification and the extension of the general procedure also described in [98] was addressed in [129] by Dr. Simani, thus representing his main contribution to the problem of the design of a bank of fuzzy estimators for fault detection and isolation of the diesel engine. Dr. Simani investigated the problem in its different aspects covering the model structure, the parameter identification method, the residual generation technique, and the fault diagnosis strategy. The case study of a real diesel engine is considered in order to demonstrate the effectiveness of the proposed methodology, thus representing the important contribution in this field achieved by Dr. Simani.

- [130] S. Simani and P. Castaldi, "Active Actuator Fault Tolerant Control of a Wind Turbine Benchmark Model," *International Journal of Robust and Nonlinear Control*, vol. 24, pp. 1283–1303, May–June 2014. John Wiley. DOI: 10.1002/rnc.2993.
- [134] S. Simani and P. Castaldi, "Data-Driven and Adaptive Control Applications to a Wind Turbine Benchmark Model," *Control Engineering Practice*, vol. 21, pp. 1678–1693, December 2013. Special Issue Invited Paper. ISSN: 0967-0661. PII: S0967-0661(13)00155-X. DOI: 10.1016/j.conengprac.2013.08.009.
- [147] S. Simani, S. Farsoni, and P. Castaldi, "Fault Diagnosis of a Wind Turbine Benchmark via Identified Fuzzy Models," *IEEE Transactions on Industrial Electronics*, vol. 62, pp. 3775–3782, June 2014. Invited paper for the special issue "Real-time fault diagnosis and fault tolerant control". DOI: 10.1109/TIE.2014.2364548.
- [150] S. Simani, S. Farsoni, and P. Castaldi, "Wind Turbine Simulator Fault Diagnosis via Fuzzy Modelling and Identification Techniques," *Sustainable Energy, Grids and Networks*, vol. 1, pp. 45–52, March 2015. ISSN: 2352-4677. DOI: 10.1016/j.segan.2014.12.001. PII: S2352-4677(15)00006-5.

The references [130], [134], [147] and [150] investigate the common aspect of the fault diagnosis and the fault tolerant (also defined as "sustainable") control for wind turbine systems. Since 2009, Dr. Simani has been analysing the problem of the improvement of the availability of wind turbines, and how to avoid catastrophic consequences, which require the detection of faults in their earlier occurrence is fundamental. Therefore, Dr. Simani's main contribution consists of the development of a fault diagnosis scheme relying on identified fuzzy models. Dr. Simani suggests the fuzzy theory in the works [147] and [150] since it allows to approximate uncertain models and managing noisy data. These fuzzy models, in the form of Takagi-Sugeno prototypes, represent the residual generators used for fault detection and isolation. On the other hand, in the work [134] Dr. Simani suggested to use linear parameter varying strategies for the design of adaptive controllers that are able to cope with uncertainty and disturbance affecting the monitored system. The novel strategy proposed by Dr. Simani in [130] allows to exploit the NLGA disturbance decoupling approach proposed e.g. in [106], which for the first time was applied to the wind turbine simulator. Finally, the important achievements and the successful results obtained in this field are demonstrated by the awards and prizes received by Dr. Simani in 2011 during the IFAC WC in Milan (Italy), in 2012 at the IFAC SafeProcess symposium in Mexico City (Mexico), and the latest IFAC WC 2014 in Cape Town (South Africa), as reported in Section 2.3, 2.4 and 3.4 of this Curriculum. The same methodologies were also implemented in the product developed in the "Road Wind" (2012 - 2013) and "Air Energy" (2013 - 2014) technology transfer projects recalled in Sections 2.3, 2.4 and 3.4 of this Curriculum

1.3 The complete list of all the significant publications of the candidate, including those listed at Section 1.2, are reported at the end of Dr. Simani's Curriculum.

2. Coordination of Research, Technology Transfer Groups and Projects.

2.1 Scientific responsibility (Principal Investigator) of competitive National and International research projects, awarded through a peer-review process

- PRIN 2008 (Project of National Interest funded by the Italian Ministry of University and Research, 2008 – 2012): Title: "Development of a technological demonstrator of a CUAV (Civil Unmanned Aerial Vehicle) for testing novel guidance and fault tolerant control schemes for patrolling and rescue missions in harsh environment". Dr. Simani, local coordinator.
- PRIN 2005: National Interest Research Project entitled "Object-oriented methods with application to the modelling of mechatronic systems", project Funded by the MIUR, Ministry of the University and Scientific Research. National coordinator Prof. Cesare Fantuzzi, University of Modena and Reggio. Silvio Simani, principal investigator.
- COFIN 2002: National Interest Research Project entitled "Fault detection and diagnosis, control reconfiguration: methodologies and tools for the supervision of industrial automation systems" funded by MIUR, Ministry of the University and Scientific Research. National coordinator, Prof. Edoardo Mosca. Local coordinator Prof. Claudio Bonivento, University of Bologna.

2.2 Coordination and management of research groups, possibly with international relationships and collaborations; explicit mention of the number and of the type of PhD and Post-Doc students, of whom the candidate has been the academic supervisor

- 2004 – 2008. Cooperation, research project and technology transfer regarding the fault diagnosis and supervision of industrial and power systems. This research topic involved Universities such as the Control and Intelligent Systems Engineering Department, The University of Hull, United Kingdom (Prof. Ron J. Patton) and The Department of Electronic & Electrical Engineering (EEE), University of Strathclyde, Glasgow, Scotland (Prof. Mike J. Grimble). The research addresses the development of identification strategies for the development of control and diagnosis schemes in the presence of disturbance, uncertainty and errors. These methodologies are applied to power systems, chemical processes, and industrial plants.
- 2000 - 2001. Post-doc research contract and technology transfer project. Coordinator Prof. R. J. Patton from the University of Hull (United Kingdom) within the European Project "EC FP5 Research Training Network DAMADICS, Development and Application of Methods for Actuator Diagnosis in Industrial Control Systems". The research project was focused on the development of fault diagnosis technique for the actuators and sensors of an industrial process.
- 2000. Research contract funded by the Industrial Engineering Group of the Department of Engineering of the University of Ferrara (coordinator Prof. Roberto Bettocchi). It regarded the development of methodologies for the automatic diagnosis of the fault affecting the measurement sensors of industrial gas turbines.
- 1998 - 2000. Collaboration with the University of Hull (UK) within the Network: EC FP5 Research Training Network DAMADICS, "Development and Application of Methods for Actuator Diagnosis in Industrial Control Systems", Contract Number: HPRN-CT-2000-00110. Network Co-ordinator: Prof. Ron J. Patton; host institution: School of Engineering, University of Hull (UK).
- 1997 - 1998. Cooperation with the National Institute of Nuclear Physics (I.N.F.N) of the University of Ferrara, and with the CERN - the European Organization for Nuclear Research, Geneva, Swiss, for the design a winding machine robot prototype oriented to the development of corrector magnets of the Large Hadron Collider (LHC).

- 1995 - 1997. Cooperation project with the Science and Supercomputing at CINECA. Title: "Visual Motion Estimation": Development of a Software for the Reconstruction of the Motion and the 3D Structure of Objects from Monocular Digital Images. CINECA Computing Centre. Casalecchio di Reno, Bologna (Italy).

2.3 Scientific responsibility of National and International research projects, ruled through partnership agreements with companies and/or public private bodies, which are leaders in their own sector

- 2013 – 2014. Coordinator of the Air Energy Project: UnifeCUP 2014 (Business Plan Competition of the University of Ferrara): development of the business idea and business plan with reference to the project entitled "Road Wind – The use of the turbulent air generated by moving vehicles as source of sustainable and green energy", project funded by the University of Ferrara and the Chamber of Commerce of Ferrara. Research support gained: 5.000 Euro.
- 2012 – 2013. Scientific coordinator of the "Road Wind" Project – The use of the turbulent air generated by moving vehicles as source of sustainable and green energy, project funded by the University of Ferrara and the Chamber of Commerce of Ferrara. Research support gained: 50.000 Euro.
- 2011. Coordinator of the Regional Project within the SPINNER 2011 programme that aimed at preparing young people to research and technological innovation activities. The initiative was devoted to the development of industrial mobile robots with trajectory optimisation and energy consumption reduction. The project involved several companies (e.g. VM Motors, Cento, Italy), and the Universities of Modena, Reggio Emilia, Bologna and Ferrara. The industrial research project regarded issues of experimental development, technology transfer; organizational, managerial and financial innovations. The project was finally approved within the SPINNER 2011 programme (Ref. No. 062/11-dott).
- 2006 - 2007. Technology Transfer Project regarding the development of a system for the supervision and control of a hybrid vehicle with advanced capabilities. This activity was developed within the Regional Project PRRIITT Mis. 3.1.A n491 cod PR04AWEXJU, in cooperation with the Department of Engineering of the University of Ferrara, and the company EnerBLU S.r.l., Modena, Italy. Scientific coordinators: Prof. Giorgio Vannini (Dean of ENDIF UNIFE), Dr. Silvio Simani, and Dr. Marcello Bonfè. Research support gained: 25.000 Euro.
- 2006 - 2012. Technology Transfer Project entitled: "Towards the virtual motor thermal-fluid-dynamic modelling of advanced diesel engines via software tools, practical experiments, and test rigs" (application nr. DM28633, Art.12EMec). The project concerned the modelling the diesel engine subsystems, together with the design of the control strategies of the Electronic Control Unit. The design is oriented to the reduction of both the fuel consumptions and the pollution emissions. Cooperation among Consorzio Ferrara Ricerche (CFR), the Department of Engineering of the University of Ferrara (scientific coordinator Dr. Silvio Simani), and the local company VM Motors S.p.A, Cento (FE), Italy. Research support gained: 26.000 Euro.
- 2006 - 2008. Industrial research, innovation and technology transfer within the Regional Programme PRRIITT 2006 Project entitled: SiGeVAMA 2006 System for the management of multipurpose vehicles with airport applications (local coordinator Dr. Silvio Simani). Laboratory for the management of the aircraft traffic, funded by the Region Emilia

Romagna. The project regarded the management of multipurpose vehicle systems, with application to airports. Research support gained: 250k Euro.

- 2004 - 2006: Cooperation and technology transfer project with the University of Hull (UK, Prof Ron J. Patton), EADS - Astrium ESTEC (Toulouse, France, Dr. Bernard Polle) and ESA (European Aerospace Agency, Holland, Dr. Denis Fertin) with the title: "Robust Estimation for Failure Detection", Ref: EAA.TCN.89079.ASTR. The main aim of the project was the development of a supervision module with application to the aerospace system. The system under investigation consisted of the MARS EXPRESS satellite model, which represents a distributed system, in the presence of uncertainty and disturbance. In particular, the main point was the design of a comprehensive methodology that allows the supervision, the fault detection and isolation of the gyroscopes and thrusters of the Mars Express Satellite. Research support gained: 60k Euro.
- 2003 - 2004: Technology Transfer Project regarding the design and result analysis of a model prototype for the estimation and 36 hours ahead prediction of the gas consumption in the northeast Italy. Cooperation funded by the Society GECO System (Geographical Environmental Consulting) and the Regional Company HERA (Holding Energy Resources environmental) FC, Cesena. Research support gained: 2500 Euro.

2.4 Outcomes obtained in the field of technology transfer, in terms of participation in start-ups and spin-offs, development, use and commercialisation of patents/licenses

- 2013 - 2014. UnifeCUP 2014 (Business Plan Competition of the University of Ferrara): award for the best business idea and business plan with reference to the project entitled "Road Wind – The use of the turbulent air generated by moving vehicles as source of sustainable and green energy", project funded by the University of Ferrara and the Chamber of Commerce of Ferrara.
- 2014. 3rd place for the best software solution to the FDI and FTC problem in the "Competition on Fault Detection and Fault Tolerant Control for Wind Farms". Award sponsored by kk-electronic a/s (Denmark) and MathWorks (USA) during the 19th World Congress of the International Federation of Automatic Control – IFAC'14, vol. 19, (Cape Town, South Africa), IFAC & South Africa Council for Automation and Control, IFAC, 24–29 August 2014. The solution was described in the conference paper [141].
- 2012. 3rd place for the best software solution to the FTC problem in the "Competition on Fault Detection and Fault Tolerant Control for Wind Turbines". Award sponsored by kk-electronic a/s (Denmark) and MathWorks (USA) 8th SAFEPROCESS, IFAC International Symposium on Fault Detection, Supervision and Safety for Technical Processes. Mexico City, Mexico, 29 - 31 August 2012. The solutions were described in the conference papers [122] and [123].
- 2011. Finalist for one of the best software solutions to the FDI problem in the "Competition on Fault Detection and Fault Tolerant Control for Wind Turbines" Award sponsored by kk-electronic a/s (Denmark) and MathWorks (USA) 18th IFAC World Congress, August 29 to September 2, 2011, Milano, Italy. The solutions were described in the conference papers [114] and [115].

2.5 Local Cooperative projects: FAR (Funds for Academic Research)

- FAR2014. Local funds for Academic Research, year 2014. Research project entitled "Micro hydroelectric systems as sustainable and renewable sources". Research funded by the University of Ferrara, with local coordinator Dr. Silvio Simani. Research support gained: 9000 Euro.
- FAR2013. Local funds for Academic Research, year 2013. Research project entitled "Micro-turbines for sustainable harvesting of wind energy". Research funded by the University of Ferrara, with local coordinator Dr. Silvio Simani. Research support gained: 6000 Euro
- FAR2012. Local funds for Academic Research, year 2012. Research project entitled "Methodologies and tools for the supervision and control of Unmanned Aerial Systems". Research funded by the University of Ferrara, with local coordinator Dr. Silvio Simani. Research support gained: 5000 Euro
- FAR 2011. Local funds for Academic Research, year 2011. Research project entitled "Coordination, path optimization, and supervision of automatic carts". Research funded by the University of Ferrara, with local coordinator Dr. Silvio Simani. Research support gained: 5000 Euro
- FAR 2010. Local funds for Academic Research, year 2010. Research project entitled "Automatic supervision and fault tolerant control for civil unmanned aerial systems". Research funded by the University of Ferrara, with local coordinator Dr. Silvio Simani. Research support gained: 4000 Euro
- FAR 2009. Local funds for Academic Research, year 2009. Research project entitled "Design of a diagnosis scheme and fault tolerant control for civil aircraft". Research funded by the University of Ferrara, with local coordinator Dr. Silvio Simani. Research support gained: 6000 Euro
- FAR 2008. Local funds for Academic Research, year 2008. Research project entitled "Supervision and automatic fault diagnosis for dynamic processes using identification techniques". Research funded by the University of Ferrara, with local coordinator Dr. Silvio Simani. Research support gained: 5000 Euro
- FAR 2007. Local funds for Academic Research, year 2007. Research project entitled "Development of a software tool for the identification, the fault diagnosis and the supervision of mechatronic systems". Research funded by the University of Ferrara, with local coordinator Dr. Silvio Simani. Research support gained: 6000 Euro

3. National and international reputation and professional activity for the scientific community

3.1 Participation in the Editorial Board of Journals with international reputation (in the role of Associate Editor or equivalent), participation in the Editorial Board of book series, encyclopaedias and essays of recognized prestige

- Since 2010, Associate Editor of the International Journal of Applied Mathematics and Computer Science – AMCS. Owner/Publisher: University of Zielona Góra & Lubuskie Scientific Society. ISSN: 1641-876X (print), 2083-8492 (online). <https://www.amcs.uz.zgora.pl/?action=editors>
- Since 2014, Subject Editor of the International Journal of Robust and Nonlinear Control, John Wiley & Sons. ISSN: 1099-1239. <http://onlinelibrary.wiley.com/>

- Since 2015, Subject Editor of the International Journal of Adaptive Control and Signal Processing, John Wiley & Sons. ISSN: 1099-1115. <http://onlinelibrary.wiley.com/>

3.2 Official research and/or teaching and/or fellowship roles, positions as Scholar/ Visiting Professor in international highly qualified universities and research centres

- September 2000 – December 2000, September 2001 – December 2001. Post Doc Research Fellow. Department of Mathematics & Engineering, The University of Hull, Hull (UK). Development and Application of Methods for Actuator Diagnosis in Industrial Control Systems. The research activity was focused on the development of fault diagnosis technique for the actuators and sensors of an industrial process.

3.3 Offices in the Governing bodies of national and international scientific societies

- Since 1998, Member of the IEEE Institute of Electrical & Electronic Engineers
- Since 2000, Member of the IFAC Technical Committee SAFEPROCESS (Fault Detection, Supervision and Safety of Technical Processes) "Technical Committee", chairman, Prof. Thomas Parisini, Working Group "Soft Computing Approaches to Fault Diagnosis and Identification". <http://tc.ifac-control.org/6/4/members>.
- Since 2002, Coordinator of the Department of Engineering at the University of Ferrara for the Excellence Network MONET on the issues "Model Based Systems and Qualitative Reasoning". Department of Computer Science, University of Wales, United Kingdom.
- Since 2006, IEEE Senior Member, The Institute of Electrical and Electronics Engineers, Inc. http://www.ieee.org/membership_services/membership/senior/index.html.
- Since 2008, member and vice-chair of the Steering Committee of the Intelligent Control and Diagnosis working group, which organises the European Advanced Control and Diagnosis (ACD) annual workshops and the International triennial Conferences on Control and Fault-Tolerant Systems (SysTol) (<http://www.icd.cran.uhp-nancy.fr/home.html>, <http://www.icd.cran.uhp-nancy.fr/who.html>).
- Since 2008, coordinator of the Erasmus Project between the Department of Engineering of the University of Ferrara and the IZMIR Institute of Technology, (IZMIR, Turkey).
- Since 2010, coordinator of the Erasmus Project between the Department of Engineering of the University of Ferrara and the Higher Vocational School in Glogow, Poland (Prof. Marcin Witczak).

3.4 Prizes and awards awarded to the candidate for Dr. Simani's scientific activity and project activity in the Academic Fields (*"Settori Concorsuali"*), where this is appropriate.

- 2014. UnifeCUP 2014 (Business Plan Competition of the University of Ferrara): award for the best business idea and business plan with reference to the project entitled "Road Wind – The use of the turbulent air generated by moving vehicles as source of sustainable and green energy", project funded by the University of Ferrara and the Chamber of Commerce of Ferrara.
- 2014. 3rd place for the best software solution to the FDI and FTC problem in the "Competition on Fault Detection and Fault Tolerant Control for Wind Farms". Award

sponsored by kk-electronic a/s (Denmark) and MathWorks (USA) during the 19th World Congress of the International Federation of Automatic Control – IFAC'14, vol. 19, (Cape Town, South Africa), IFAC & South Africa Council for Automation and Control, IFAC, 24–29 August 2014. The solution was described in the conference paper [141].

- 2012. 3rd place for the best software solution to the FTC problem in the "Competition on Fault Detection and Fault Tolerant Control for Wind Turbines". Award sponsored by kk-electronic a/s (Denmark) and MathWorks (USA) 8th SAFEPROCESS, IFAC International Symposium on Fault Detection, Supervision and Safety for Technical Processes. Mexico City, Mexico, 29 - 31 August 2012. The solutions were described in the conference papers [122] and [123].
- 2011. Finalist for one of the best software solutions to the FDI problem in the "Competition on Fault Detection and Fault Tolerant Control for Wind Turbines" Award sponsored by kk-electronic a/s (Denmark) and MathWorks (USA) 18th IFAC World Congress, August 29 to September 2, 2011, Milano, Italy. The solutions were described in the conference papers [114] and [115].

3.5 Participation in international conferences, as a distinguished invited speaker; participation in the scientific committees of International Conferences

- November 2015. Invited plenary talk entitled: "Advanced Issues of Wind Turbine Modelling and Control". Invited plenary talk for the ACD 2015 - The 12th European Workshop on Advanced Control and Diagnosis. European Centre of Excellence (NTIS), Faculty of Applied Sciences, University of West Bohemia, Pilsen, Czech Republic. November 19 - 20, 2015.
- September 2015. Invited plenary talk entitled: "Advanced Issues of Wind Turbine Modelling and Control". Invited plenary talk for the ICSE 2015 - 24th International Conference on Systems Engineering 2015 8 - 10 September, Coventry, UK.
- August 2014. Talk entitled: "Nonlinear Fault Diagnosis and Fault Tolerant Control Schemes for Aerospace Applications". Invited contribution to the Tutorial Workshop organised at the IFAC World Congress 2014 by Prof. Youmin Zhang. Cape Town, South Africa. August 24th, 2014. The presentation held by P. Castaldi and S. Simani is entitled "Nonlinear Fault Diagnosis and Fault Tolerant Control Schemes for Aerospace Applications" within the Pre-Congress Tutorial "Fault Diagnosis, Fault-Tolerant Control, and Cooperative Control on Manned and Unmanned Aircraft Systems". Abstract of the Pre-Congress Tutorial. Presentation and schedule of the pre-congress tutorial by Prof. Zhang.
- February 2014. Data-Driven and Model-Based Robust Fault Diagnosis and (Fault Tolerant) Control of a Wind Turbine Model. Invited talk for the international EU meeting and workshop. The Faculty of Engineering and Science, Department of Electronic Systems, Automation and Control, Aalborg University, Fredrik Bajers Vej 7, C2-214, 9220, Aalborg, Denmark. February 11-12, 2014.
- June 2013. A Wind Turbine Benchmark Model for a Fault Fault Detection and Isolation Competition. Invited talk for the MathWorks Research Faculty Summit. June 1-3, 2013, Newton Marriott Newton, Newton, Massachusetts (USA).
- September 2011. Talk entitled "Model Model-Based Fault Diagnosis for Dynamic Processes Using Identification Techniques". Plenary talk within the 10th International Science and

Technology Conference Diagnostics of Processes and Pag. 19 di 22 Systems DPS'2011. 19 - 21 September 2011, Zamosc, Poland.

- September 2009. Semi-plenary talk entitled "INTEGRATED FAULT DIAGNOSIS AND FAULT TOLERANCE CONTROL DESIGN FOR AN AIRCRAFT MODEL" at the International Conference on Systems Engineering (ICSE). 8-10 September 2009, Coventry University, Coventry, UK. The Control Theory & Applications Center.
- April 2009. Seminar entitled "Turbocharged Diesel Engine Modelling for Nonlinear Engine Control". International Workshop 2009 on "Hybrid and Predictive Control for Nonlinear Industrial Applications". University of Strathclyde, Court Senate/Suite, Collins Building, 22 Richmond Street, Glasgow, Scotland. Applied Control Technology Consortium. 28, 29, and 30 April 2009.
- March 2009. Invited Talk within the Workshop "Advanced FDI/FTC in future European Commission Framework". Presentation entitled "Development and Application of Advanced Control Design Techniques for Challenging Dynamic Processes". University Duisburg - Essen. Institute for Automatic Control and Complex Systems (AKS). Gerhard-Mercator - Haus. 57, Lotharstr. 47048 Duisburg, Germania. 8 - 9 March, 2009.
- September 2008. Talk entitled "Residual Generators and Adaptive Filters for the Diagnosis of Aerial Systems" within the SIDRA 2008 - National Annual Meeting - Italian Society of Professors and Researchers on Automation, organised at the Department of Technique and Management of Industrial Systems (DGT) in Vicenza of the University of Padova. Stradella S. Nicola, 3 - 36100 VICENZA. September 11-13, 2008.
- April 2008. Invited seminar at VM Motors Company, Cento (FE), Italy, entitled "Fuzzy Modelling of Diesel Engine and Automatic Tuning of ECU Strategies". The seminar was organised within the Technology Transfer Project "Design and Development of Software Modules for the engine control oriented to the enhancement of the efficiency of the actual diesel engine, with consumption and pollutant emission reduction", research contract between the Company VM Motors (Cento, FE) and the Dipartimento di Ingegneria, Università di Ferrara. 1st April 2008.
- September 2007. Talk entitled "Development and Application of Design Techniques for Industrial Application" within the annual Workshop "Advances in Real-Time Control of Nonlinear Systems" organised by Prof. M. J. Grimble of the University of Strathclyde, Court Senate/Suite, Collins Building, 22 Richmond Street, Glasgow, Scotland. 5th, 6th and 7th September 2007.
- May 2007. Talk entitled "Problems and Tools for the fault Detection and Diagnosis" within the tutorial seminar with title "Fault Detection and Management in Industrial Automation", organised by Prof. Sauro Longhi, Dipartimento di Ingegneria Informatica, Gestionale e dell'Automazione, dell'Università Politecnica delle Marche, Ancona, Italy. 31 May 2007.
- November 2004. Invited talk entitled "Design of Residual Generators for Aircraft Fault Diagnosis" within the 4th ACD Workshop 2004 "Workshop on Advanced Control and Diagnosis". Universitat Karlsruhe, Forschungszentrum Umwelt, Adenauerring 20, D76131 Karlsruhe, Germany. 1718 November, 2004. Karlsruhe University, Germany.
- April 2003. Invited talk entitled "Dynamic neural networks for actuator fault diagnosis: application to the Damadics benchmark problem" given during the European School on the topics "Structural Analysis and Bond Graph" within the European Project RTN DAMADICS. Lille (France), 9 11 April 2003.

- July 2002. Invited talk entitled "Identification approaches to dynamic process FDI" within the Mid Term Review Meeting for the Research Training Network - DAMADICS. Barcelona, Spain. 21st July 2002
- July 2002. Lecture entitled "Nonlinear System Modelling from Noisy Data & FDI Using MultipleModel Approach" within the Tutorial Workshop "Fault detection and isolation in nonlinear systems" organised at the IFAC World Congress 2002 by Prof. Michel Kinnaert, Department of Control Engineering and System Analysis Université Libre de Bruxelles (Free University of Brussels). 21 July, 2002. Barcelona, Spain.

3.6 Management and organization of exhibitions, compositions, drawings, design, hand-crafted items, prototypes, artwork and their projects, databases and software, thematic maps, for the Academic Fields (*"Settori Concorsuali"*), where this is appropriate.

- August 2014. Organiser of the special session "FDI and FTC of Wind Turbines in Wind Farms" in the 19th World Congress of the International Federation of Automatic Control – IFAC'14, vol. 19, (Cape Town, South Africa), IFAC & South Africa Council for Automation and Control, IFAC, 24–29 August 2014.
- December 2013. Organiser of the proposed special invited session for the problem of Fault Diagnosis and Fault Tolerant Control for Wind Farms. 52nd IEEE Conference on Decision and Control – CDC2013 (I. Control Systems Society, ed.), (Florence, Italy), IEEE Control Systems Society, IEEE Control Systems Society, 10–13 December 2013. Award sponsored by kk-electronic a/s (Denmark) and MathWorks (USA).
- October 2013. Organiser of the invited sessions for the problem of Health Monitoring, Fault Diagnosis and Fault Tolerant Control for Wind Turbines. 2nd International Conference on Control and Fault-Tolerant Systems – SysTol'13 (I. Control Systems Society, ed.), (Nice, France). Centre de Recherche en Automatique de Nancy – CRAN, IEEE Control Systems Society, 9–11 October 2013.
- August 2012. Organiser of the invited sessions for the international "Competition on Fault Detection and Fault Tolerant Control for Wind Turbines". Award sponsored by kk-electronic a/s (Denmark) and MathWorks (USA) – 8th SAFEPROCESS, IFAC International Symposium on Fault Detection, Supervision and Safety for Technical Processes. Mexico City, Mexico, 29 - 31 August 2012.
- September 2, 2011. Organiser of the invited sessions for the international "Competition on Fault Detection and Fault Tolerant Control for Wind Turbines" Award sponsored by kk-electronic a/s (Denmark) and MathWorks (USA) – 18th IFAC World Congress, August 29 to September 2, 2011, Milano, Italy.
- November 2010. Organizer and general chair of the 8th European Workshop on Advanced Control and Diagnosis - EACD 2010. 18-19 November 2010, Department of Engineering of the University of Ferrara, Ferrara, Italy. www.acd2010.it
- Since 1999, organizer of many invited sessions at the IEEE and IFAC International Conferences such as CDC, ECC, IFAC WC, SAFEPROCESS's Symposia, and member of the Technical Committee at the IEEE and IFAC Societies

In order to evaluate properly the applicants' scientific reputation, a qualifying element to be considered is the National Scientific Qualification obtained by the applicant in more than one Field of the same disciplinary area, as well as the I level National Scientific Qualification obtained by the applicant in the Field concerned by the notice of competition and/or in the Fields of the same disciplinary area (for a definition of Disciplinary area, please refer to sections 1-14 defined by CUN-Italian National University Council).

TEACHING ACTIVITY

4 Teaching Activity

4.1 Formal responsibility of Bachelor's (Laurea) and Master of Science's (Laurea Magistrale) degree courses in Italian universities

- Academic Calendar Years 2015/16 and 2013/14. Course module of "Control Techniques and Fault Diagnosis". For the master students of Automatic Control, Informatics, Telecommunications and Electronics Engineering Students. Department of Engineering, University of Ferrara. 60 hours.
- Academic Calendar Year 2010/2011. Course module of "Automatic Fault Diagnosis Techniques" and "Model-Based Approaches to Automatic Fault Diagnosis for Dynamic Systems". For the master students of Automatic Control, Informatics, Telecommunications and Electronics Engineering Students. Department of Engineering, University of Ferrara. 60 hours.
- Academic Calendar Year 2010/2011. Course module of "Nonlinear Control Techniques". For the master students of Automatic Control, Informatics, Telecommunications and Electronics Engineering Students. Department of Engineering, University of Ferrara. 60 hours.
- Academic Calendar Years 2015/16, 2014/15, 2013/14, 2012/13, and 2011/12. Course module of "Digital Control Systems". For the bachelor students of Automatic Control, Informatics, Telecommunications and Electronics Engineering Students. Department of Engineering, University of Ferrara. 90 hours.
- Academic Calendar Years 2010/11, 2009/10, 2008/09, 2007/08, 2006/07, 2005/06, 2004/05, and 2003/04. Course module of "System Identification and Data Analysis". For both bachelor and master students of Automatic Control, Informatics, Telecommunications and Electronics Engineering Students. Department of Engineering, University of Ferrara. 60 hours.
- Academic Calendar Years 2010/11, 2009/10, 2008/09, 2007/08, 2005/06, 2004/05, 2003/04, 2002/03, 2001/02, 2000/01, and 1999/00. Course module of "Digital Control and Computer Aided Design". For the bachelor students of Automatic Control, Informatics, Telecommunications and Electronics Engineering Students. Department of Engineering, University of Ferrara. 60 hours.
- Academic Calendar Years 2007/08, 2006/07, 2005/06, 2004/05, and 2003/04. Course module of "Neural Networks and Fuzzy Systems for Identification, Prediction and Control" within the course of "System Automation" (held by Prof. Sergio Beghelli). For the master students of Automatic Control, Informatics, Telecommunications and Electronics Engineering Students. Department of Engineering, University of Ferrara. 60 hours.
- Academic Calendar Years 2007/08, 2006/07, and 2005/06. Course module of "Fault Diagnosis of Dynamic Systems Using Model-Based and Filtering Approaches" within the course of "Automatic Fault Diagnosis" (given by Prof. Pier Ruggero Spina). For the master

students of Automatic Control, Informatics, Telecommunications and Electronics Engineering Students. Department of Engineering, University of Ferrara. 60 hours.

- Academic Calendar Year 1998/99. Permanent cooperation for the practical lectures of the Course of "Automatic Control", For the bachelor students of Automatic Control, Informatics, Telecommunications and Electronics Engineering Students. Department of Engineering, University of Ferrara.
- Dr. Simani is currently member of the evaluation commissions for all the abovementioned courses.

4.2 Formal responsibility of PhD courses in Italian and/or foreign universities.

- Member of the Commission for the Ph.D. Course in "Engineering Sciences". Faculty of Engineering, University of Ferrara.
- Seminar entitled "Model Based Fault Detection and Isolation: Linear Polynomial Methods for FDI with Aircraft Applications". 16 hours course for the European Ph.D. on Information Technology organised at the ARCES (Advanced Research Center on Electronic Systems for Information and Communication Technologies "Ercole De Castro") of the University of Bologna. Academic Calendar Years 2010/2011 and 2011/2012.
- January 2005. Seminar entitled: "Residual Generator Computation via Polynomial Approach for FDI". Course for the European Ph.D. in Information Technology at ARCES Centre (Advanced Research Center on Electronic Systems for Information and Communication Technologies Ercole De Castro) of the Università di Bologna.

4.3 Formal responsibility of Specializing Master's courses and Life Learning courses in Italian and/or foreign universities in PhD courses.

- July 2008. Seminar entitled "Sensor Data Fusion" within the second International Summer School on the topic "Advanced Technologies for Neuro Motor assessment and rehabilitation" (in English). The Summer School was organised within the Regional Project PRRIITT "STARTER", Strategic Network for Assistive and Rehabilitation Technology funded by Region Emilia Romagna and promoted by the Dipartimento di Elettronica, Informatica e Sistemi of the Università di Bologna.
- November 2000. Cooperation for the teaching activity of "Control Automation and Robotics" within the Technical Activities of the Higher School IFTS oriented to the training of Industrial Automation Technicians, funded by Region Emilia Romagna, Italy.

5 Institutional offices and roles in Italian and foreign Universities and/or public and private institutions with scientific and/or technology transfer aims

- 2001 – 2015. Supervisor of two Ph.D. students (2006-2009, Dr. Matteo Benini, and 2012-2015, Dr. Saverio Farsoni, Department of Engineering, University of Ferrara), about forty (50) Bachelor students, and fifty (30) final MS students (2001-2015).

- 2012 – 2013. External Evaluator for Ph.D. candidates at the Control Theory and Applications Centre (CTAC) Faculty of Engineering and Computing, Coventry University, Coventry, UK and at the Universitat Politècnica de Catalunya, Barcelona, Spain.
- 2010 – today. Member of the commission for the evaluation of minimal requirements in Mathematics and Logics of the enrolled students in Electronics and Informatics Engineering, Department of Engineering, University of Ferrara. See the link below in Italian:

<http://www.unife.it/ing/civile/faq/prova-di-verifica-delle-conoscenze-iniziali-di-matematica-minimat>

- 2015 – today. Member of the Self-Evaluation Group (Gruppo di Autovalutazione, GAV) for the Academic Discipline Ing-Inf/04 – Automatica, for the Bachelor degree in Electronics and Informatics, as well as the MSc degree in Information Science at the department of Engineering of the University of Ferrara. See the link below in Italian:

<http://www.unife.it/ing/informazione/verbali/gruppo-di-autovalutazione>

- 2012 – today. Member of the Staff-Student Joint Committee – SSJC (Commissione Paritetica Docenti-Studenti dell'Ateneo di Ferrara) at the Department of Engineering of the University of Ferrara. See the link below in Italian:

<http://www.ing.unife.it/it/didattica/valutazione-di-qualita/commissione-paritetica-12-13>

- 2008 – 2012. Responsible manager of the Teaching Activities Safety Management (Preposto per le Attività Didattiche della Facoltà di Ingegneria di Ferrara, Gestione della sicurezza - Nomina Preposti, come previsto dall'art. 6 del Regolamento per la gestione della sicurezza sul lavoro in Ateneo), required from 2008 to 2012 by the University of Ferrara regulations and their effective actuation of the rules concerning the safety and health at work. See the link below in Italian:

<http://www.unife.it/ateneo/uffici/ripartizione-sicurezza-salute-ambiente/ufficio-sicurezza/>

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Ferrara, December 1st, 2015

Signature: Silvio Simani

A handwritten signature in blue ink that reads "Silvio Simani". The signature is written in a cursive, flowing style with a large initial 'S'.