Expert C.V.

SILVIO SIMANI

Type of Expert

FP6 Expert	Yes
FP7 Expert	Yes
Type of Expert	Evaluator/Reviewer Monitor
Non-FP Expert	No

Personal Details

Candidature number	**EX2006C104837**
1. **Title***	Dr.
2. **Family name** (current)* State your current family name, completely.	**SIMANI**
3. **First name*** State your principal first name, completely.	**SILVIO**
4 . **Sex** *	male
5. **Date of birth** (DD/MM/YYYY)* Ex.: For 20 July 1957, write 20/07/1957.	21/04/1971
6. **Town of birth***	Ferrara
7. **Country of birth***	Italy
8 . **Nationality*** The Commission will try to ensure a balanced participation with regard to geographical origin of applicants.	Italy
9. **Passport number / Identity card number***	B325720
10. **Second nationality if appropriate**	

Contact Details

11. **Street number and name*** Commencing with the number of the building (then an apartment or floor number), then …Street or …Avenue etc., state your complete address.Ex.: 11 bis A Church Street	1 F, Via Bologna
12. **Town/city*** State the name of the town where you live.	Ferrara
13. **Country***	Italy

14. **Postal code** State your postal code without the national prefix (e.g. 1049, not B-1049)	44100
15. **PO BOX**	
16. **Telephone number 1*** country - prefix - Regional code - Telephone number (Ex..: 49 1331 1234567)	+39 0532 97 4844
17. **Telephone number 2** country - prefix - Regional code - Telephone number (Ex..: 49 651 1234567)	+39 347 9421171
18. **FAX number 1** country - prefix - Regional code - FAX number (Ex..: 49 1331 1234567)	+39 0532 97 4870
19. **FAX number 2** country - prefix - Regional code - FAX number (Ex..: 49 651 1234567)	+39 0532 769310
20. **E-mail 1***	SILVIO.SIMANI@UNIFE.IT
21. **E-mail 2**	ssimani@ing.unife.it
22. **TVA / VAT number**	

Linguistic Skills

	Languages	Written	Reading	Conversation
23. **Language 1**: *	Italian	Fluent	Fluent	Mother Tongue
24. **Language 2**:	English	Good	Good	Good
25. **Language 3**:				

FP Activities

26. **FP6 Activity Codes**

1.	**2.**	**3.**
4.	**5.**	**6.**

27. **FP7 Themes**

1. Embedded systems, computing and control	**2.** Robotic systems	**3.**
4.	**5.**	**6.**

Keywords

28. **Please enter some Freestyle keywords that best describe your expertise** (max 1000 characters)
Robust Fault Diagnosis, Dinamic System Identification, Fuzzy Logic, Neural Networks, Hybrid Systems - Fault Detection, Supervision and Safety for Technical Processes

Experience

29. **Curriculum Vitae:**	http://www.ing.unife.it/simani/IEEESM-CV.html
30. **Professional Experience** *	10-15 years
31. **Higher Education** *	5 years plus

32. **Describe your experience if any in Peer Review, Evaluation/Validation, Impact Assessment, Monitoring, Quality Assurance or Auditing?:**
Reviewer for several international journals and conferences, as: Automatica, IEEE Transactions on Automatic Control, International Journal of Control, IEEE Transactions on Control Systems Technology, Control Engineering Practice, International Journal of Systems Science - IJSS, Transactions of the Institute of Measurement and Control, IEEE transactions on Industrial Electronics, IEEE Transactions on Fuzzy Systems, European Journal of Control, International Journal of Intelligent Systems Technologies and Applications, IEEE Transactions on Signal Processing, International Journal of Adaptive Control and Signal Processing, International Journal of Nonlinear and Robust Control, IEEE Signal Processing Letters, IEEE Transactions on Signal Processing, IEEE Transactions on Speech and Audio Processing, IEEE Transactions on Image Process, IEEE Transactions on Industrial Informatics, International Journal on Mechatronics, Fuzzy Sets and Systems Journal, Journal of Neural Processing Letters, Journal of Latin American Applied Research - LAAR, Journal of Aerospace Computing, Information, and Communication, IFAC SAFEPROCESS Symposium, IEEE CDC Conference – Conference on Decision and Control, IEEE ACC Conference – American Control Conference, IEEE CCA Conference – Conference on Control and Applications, ECC - European Control Conference, IEEE MMAR - International Conference on Methods and Models in Automation and Control.

33. **Previous Involvement in EC Research Activities:**

34. **Have you participated previously as a Chairperson?**	no
35. **Have you participated previously as a Rapporteur?**	no

Employment History

36. **Are you currently employed or self-employed?***	yes

37. **Current Organisation**:

Job Title:*	Assistant Professor
Organisation Name:*	Department of Engineering, University of Ferrara
Organisation Street Number and Name:*	1, Via Saragat

Organisation Town/City:*	Ferrara
Organisation Country:*	Italy
Organisation Postal Code:	44100
Organisation PO BOX:	
Organisation Type:*	Others
Organisation Size:*	50-249 employees
Department/Organisation Name:*	Department of Engineering, University of Ferrara

38. **Employment Records for the last 10 years or the last 5 positions:*** (max 2,000 characters)

1996-1997. Research Fellow in Science and Supercomputing at CINECA. CINECA Computing Centre. Casalecchio di Reno, Bologna (Italy).

1998. Part Time Assistant Lecturer. Department of Engineering, University of Ferrara (Italy)

1999. Part Time Assistant Lecturer. Department of Engineering, University of Ferrara (Italy)

2000. Part Time Assistant Lecturer. Department of Engineering, University of Ferrara (Italy)

2000. Electronics & Mechanics Collaborative Project. Department of Engineering, University of Ferrara (form June to September, 2000)

2000. Post Doc Fellow. Research Contract at the Department of Mathematics & Engineering, The University of Hull (UK)

2001 Part Time Lecturer. Department of Engineering, University of Ferrara (Italy)

2002 Part Time Lecturer. Department of Engineering, University of Ferrara (Italy)

2002 Full time assistant professor & lecturer at the Department of Engineering of University of Ferrara (Italy) (since February 2002)

Interests

39 . **Synopsis of current research interests:** (max 1, 000 characters)*

1) Identification and model-based fault diagnosis of industrial processes.
2) Linear identification of dynamic processes from noisy data.

3) Fuzzy modelling, identification and control of dynamic systems.

4) Neural Networks for fault identification.

5) Hybrid model identification from noisy data

In particular, for the Fault Diagnosis topic:

1) Identification and model-based fault diagnosis of real and simulated industrial processes.

2) Actuator, component and sensor fault diagnosis using identification techniques.

3) Robust model-based methods for residual generation.

40 . **Former research interests (with dates):** (max 1, 000 characters)

1995-1997: 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.

1998-2000: EC FP5 Research Training Network DAMADICS, "Development and Application of Methods for Actuator Diagnosis in Industrial Control Systems", Contract Number: HPRN-CT-2000-00110.

2001-2003: Project for 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.

2004-2005: EADS - Astrium ESTEC (Toulouse, France) and ESA (European Aerospace Agency, Holland) with the title: "Robust Estimation for Failure Detection".

41. **Additional Information:** (max 10,000 characters)

Regarding Fault Detection and Diagnosis in Dynamic Systems, Dr. Simani's interests are in the field of fault diagnosis in dynamic systems and in particular, since 1997, he is carrying out researches into the development of methods for rapid detection and diagnosis of faults in input-output control sensors of industrial processes. The interest has been in the use of analytical redundancy methods based on information implicit in functional or analytical relationships, which always exist between a number of measurements taken from a process (e.g. industrial plant). The research has exploited methods, using robust state observers, which have provided a capability for reliable detection of faults in the presence of typical plant parameter variations. The research is being driven by industrial application studies, although a particular interest has been the development of a unifying theory for model-based diagnosis algorithms. Dr. Simani is trying to apply the experimented methods within the context of robustness to uncertainty.

Concerning the Linear & Nonlinear system identification topics, the project is concerned with problems in identification of linear and nonlinear systems. Special emphasis is given to the case of multi-input single-output (MISO) and multi-input multi-output (MIMO) systems. The latter case shows even in the linear case considerable more complexity when compared to the single-input single-output (SISO) case. The problems considered range from structure theory (realization and parameterisation) to estimation algorithms (including their evaluation).

The Fuzzy logic in control and identification item focuses on 2 points:

* Fuzzy logic in control: This activity is aimed to investigate the application of the fuzzy logic paradigm for the control and identification of dynamic system. In particular, fuzzy logic in control has been successfully used to capture heuristic control laws obtained from human experience or engineering practice in automated algorithm. These control laws are defined by means of linguistic rule. The heuristic approach in the controller design can be appealing for its simplicity, but formal design method can be mandatory in some cases.

* Fuzzy model identification: In literature a general approach to nonlinear structure modelling does not exist and then fuzzy models are interesting because they can approximate a large class of nonlinear functions. The maim problem consists in finding the parameters of the fuzzy model from data affected by noise.

The Neural Network research activity regards 2 aspects:

* Static neural networks in fault diagnosis: Neural networks can handle nonlinear behaviour and partially known process because they learn the diagnostic requirements by means of the

information of the training data.

* Dynamic neural networks in system identification: This research concerns model identification by linear and nonlinear dynamic neural networks. Linear networks may be used to model real systems. If the real system is linear or near linear then the linear network can act as a zero, or low, error model. In the real system is nonlinear, linear network models the system with minimum sum-squared error. Nonlinear networks can be used to identify a nonlinear system. Two networks are commonly used: Elman and Hopfield networks.

Finally, the Identification of Nonlinear Dynamic Systems is solved via a multiple model approach. In particular:

* The Fault diagnosis of nonlinear dynamic systems: Fault Diagnosis (FD) for industrial processes requires reliable models for effective malfunctioning detection. As linear models are seldom effective in describing complex industrial processes, more complicated non-linear models should be used for this purpose. The construction of structured non-linear model from input-output data is currently under investigation in several institutes and laboratories all over the world but is far to be fully established, especially when we consider that in industrial environment the acquired data are always affected by noise. A further problem is to consider that the identification procedure should be coupled to a fault diagnosis algorithm. In order to establish a methodology applicable in a wide class of industrial plants, we can observe that in many cases the processes can be described using simple model having a local validity around an operating condition. Therefore, instead of exploiting complicated non-linear models obtained by modelling techniques, it is also possible to describe the plant by a collection of affine models. Each submodel approximates the system locally around a working condition and a selection procedure determines which particular submodel has to be used. Such a multiple model structure is called multiple model approach. At each operating point, the behaviour of the multiple model is described by a local affine dynamic model. Several researchers currently explore this approach; among them we can cite the works by Billings and Leonaritis, Takagi and Sugeno, Branicky and Benveniste. However little attention has been paid to the problem of noise affecting plant measurements, which can significantly decrease the suitability of the model in the context of FD, in particular producing false alarms. As in practical condition the measured data are always affected by noise, this problem is really important to be carefully considered. Some preliminary study have been already carried on this stream, particularly in the context of linear models, by Kalman and Beghelli, and recently for non linear models, by Beghelli, Fantuzzi, Rovatti and Simani.

* Multiple model approach: The construction of the multiple model from only one set of global input-output noisy measurements is a non-trivial problem since the model structure, a switching function and the local model parameters have to be identified. The technique we aim to develop concerns the estimate of the operating point regions, the identification of the structure and parameters of the piecewise affine system based on local linear models from input-output data affected by noise. A non-linear dynamic process is, in fact, described as a composition of several local submodels selected according to the process operating conditions. This project addresses a method for the identification and the optimal selection of the local submodels from a sequence of noisy measurements acquired from the process. In particular, in this project, a novel non-linear identification technique is combined with the model-based method to formulate a fault detection and isolation (FDI) tool exploiting the multiple model approach for residual generation. The model for non-linear dynamic systems is described by a number of local linear models. Each submodel approximates the system locally around an operating point and a selection procedure determines which particular submodel has to be used. Under such a new identification method, a number of local linear models are designed and the estimate of outputs is given by a combination of local outputs. The diagnostic signal (residual) is the difference between the estimated and actual system output. The key idea of model-based approaches for FD is, in fact, the generation of signals, termed residuals, obtained by using observers, parameter estimation or parity equations designed on the basis of mathematical models of the monitored system. The success of the model based

method is heavily dependent on the quality of models. Instead of exploiting complicated non-linear models obtained by modelling techniques, the problem is overcome describing the plant by a collection of local linear models obtained by the non-linear identification method presented above. The contribution of this research is two fold. First, it is shown how to integrate the well-established Frisch scheme method for the identification of affine algebraic systems within a general procedure for non-linear dynamic system. Second, some interesting properties of such a Scheme can enhance the solution of the optimisation problem as well as of the continuity constraint fulfilment.

42 . **Bibliography of Publications: ref. and title:** (max 10,000 characters)

BONFE' MARCELLO, CASTALDI PAOLO, GERI WALTER, SIMANI S. (2006). Fault Detection and Isolation for On-Board Sensors of a General Aviation Aircraft. INTERNATIONAL JOURNAL OF ADAPTIVE CONTROL AND SIGNAL PROCESSING. vol. 20 (8), pp. 381-408 ISSN: 0890-6327. doi:10.1002/acs.906.

SIMANI S. (2006). Discussion on "FDI using Multiple Parity Vectors for Redundant Inertial Sensors" by Cheol-Kwan Yang & Duk-Sun Shim. EUROPEAN JOURNAL OF CONTROL. vol. 4, pp. 1-5 ISSN: 0947-3580. (Discussion paper).

SIMANI S. (2006). Fault Diagnosis of a Simulated Industrial Gas Turbine via Identification Approach. INTERNATIONAL JOURNAL OF ADAPTIVE CONTROL AND SIGNAL PROCESSING. vol. xxx, pp. 1-32 ISSN: 0890-6327. doi:10.1002/acs.924 Copyright © 2006 John Wiley & Sons, Ltd. ISSN: 0890-6327.

SIMANI S., BONFE' MARCELLO. (2006). Discussion on "A comparison of sliding mode and unknown input observers for fault reconstruction" by Christopher Edwards and Chee Pin Tan. EUROPEAN JOURNAL OF CONTROL. vol. 12 (3), pp. 270-274 ISSN: 0947-3580. (Discussion Paper).

SIMANI S., FANTUZZI CESARE. (2006). Dynamic system identification and model-based fautl diagnosis of an industrial gas turbine prototype. MECHATRONICS. vol. 16(6), pp. 341-363 ISSN: 0957-4158.

BEGHELLI S, BONFE' M, SIMANI S. (2005). Fault Diagnosis and Isolation for Dynamic Process Sensors. INARCOS. vol. 1, pp. 1-4 ISSN: 0391-6537. Mensile di Tecnica e Informazione edita dalla Associazione Ingegneri e Architetti di Bologna. URL: http://www.inarcos.net/.

SIMANI S. (2005). Identification and Fault Diagnosis of a Simulated Model of an Industrial Gas Turbine. IEEE TRANSACTIONS ON INDUSTRIAL INFORMATICS. vol. 1, pp. 202-216 ISSN: 1551-3203. Issue 3. Digital Object Identifier 10.1109/TII.2005.844425.

SIMANI S. (2003). Coding approaches to fault tolerance in combinational and dynamic systems: Christoforos N. Hadjicostis; Kluwer Academic Publishers, Dordrecht, 2002. ISBN: 0-7923-7624-2. AUTOMATICA. vol. 39 (6), pp. 1113-1115 ISSN: 0005-1098. (Book review).

FANTUZZI C., SIMANI S., BEGHELLI S., ROVATTI R. (2002). Identification of piecewise affine models in noisy environment. INTERNATIONAL JOURNAL OF CONTROL. vol. 75(18), pp. 1472-1485 ISSN: 0020-7179.

ROVATTI R, FANTUZZI C, SIMANI S. (2000). High speed DSP-based implementation of piecewise-affine and piecewise-quadratic fuzzy systems. SIGNAL PROCESSING. vol. 80(6), pp. 951-963 ISSN: 0165-1684. Special issue "Fuzzy Logic in Signal Processing".

SIMANI S., SIMANI S. (2000). Fault diagnosis in power plant using neural networks. JOURNAL OF INFORMATION SCIENCE. vol. 127(3-4), pp. 125-136 ISSN: 0165-5515. Special Issue: "Applications to Intelligent Manufacturing and Fault Diagnosis: PART 1 - Fault Diagnosis".

SIMANI S., FANTUZZI C, BEGHELLI S. (2000). Diagnosis techniques for sensor faults of industrial processes. IEEE TRANSACTIONS ON CONTROL SYSTEMS TECHNOLOGY. vol. 8(5), pp. 848-855

ISSN: 1063-6536. doi:10.1109/87.865858.

SIMANI S., FANTUZZI C, ROVATTI R., BEGHELLI S. (1999). Parameter identification for piecewise affine fuzzy models in noisy environment. INTERNATIONAL JOURNAL OF APPROXIMATE REASONING. vol. 22 (1-2), pp. 149-167 ISSN: 0888-613X.

SIMANI S., FANTUZZI C., PATTON R. J. (2002). Model-based fault diagnosis in dynamic systems using identification techniques. (vol. XIV, pp. 298). ISBN: 1852336854. Series: Advances in Industrial Control. LONDON: Springer-Verlag (UNITED KINGDOM).

BEGHELLI S, BERTONI G, BONFE' M, CASTALDI P, GERI W, SIMANI S. (2005). Design of Residual Generators for the Fault Diagnosis of General Aviation Aircraft. MONET Newsletter: ISSN 1464-9276. April 2005. (vol. 6, pp. 10-18). MONET Newsletter: European Network of Excellence on Model-based Systems and Qualitative Reasoning.

SIMANI, S: (1999)., "Model-Based Fault Diagnosis in Dynamic Systems Using Identification Techniques", Ph.D. Thesis. Department of Engineering at the University of Ferrara. Italy. November, 1999. BONFÈ M, FANTUZZI C, SIMANI S. (2006). A study of fault diagnosis and recovery techniques for manufacturing systems. In: Proceedings of the SAFEPROCESS 2006 - 6th IFAC Symposium on Fault Detection Supervision and Safety for Technical Processes. SAFEPROCESS 2006. 30 August - 1 September, 2006. (vol. CD Rom, pp. 1447-1452). Department of Automation, Tsinghua University School of Automation, Beihang University for the Chinese Association of Automation. BEIJING: IEEE CSS (CHINA).

PATTON R.J, UPPAL F.J, SIMANI S., POLLE B. (2006). Monte-Carlo Reliability and Performance Analysis of Satellite FDI System. In: MECHATRONICS 2006 - 4th IFAC Symposium on Mechatronic Systems. MECHATRONICS 2006. September 12 - 14, 2006. (vol. CD Rom, pp. 187-182). Sponsor IFAC International Federation of Automatic Control - TC on Mechatronic Systems In cooporation with • Institute of Electrical and Electronics Engineers (IEEE) • American Society of Mechanical Engineers (ASME) Organizers • VDI/VDE-Gesellschaft Mess- und Automatisierungstechnik (GMA) • Technische Universität Dresden, Institute of Automation. HEIDELBERG: IFAC (GERMANY).

PATTON R.J, UPPAL F.J, SIMANI S., POLLE BERNARD. (2006). A MONTE CARLO ANALYSIS AND DESIGN FOR FDI OF A SATELLITE ATTITUDE CONTROL SYSTEM. In: Proceedings of the SAFEPROCESS 2006 - 6th IFAC Symposium on Fault Detection Supervision and Safety for Technical Processes. SAFEPROCESS 2006. 30 August - 1 September, 2006. (vol. CD Rom, pp. 1393-1398). Department of Automation,Tsinghua University School of Automation, Beihang University for the Chinese Association of Automation. BEIJING: IEEE CSS (CHINA).

SIMANI S., BONFÈ M, CASTALDI P, GERI W. (2006). Application of Fault Diagnosis Methodologies to a General Aviation Aircraft. In: Proceedings of the SAFEPROCESS 2006 - 6th IFAC Symposium on Fault Detection Supervision and Safety for Technical Processes. SAFEPROCESS 2006. 30 August - 1 September, 2006. (vol. CD Rom, pp. 205-210). Department of Automation,Tsinghua University School of Automation, Beihang University for the Chinese Association of Automation. BEIJING: IEEE CSS (CHINA).

SIMANI S., DIVERSI R. (2006). Residual Generator Identification and Design for Linear Multivariable Systems. In: Proceedings of the SAFEPROCESS 2006 - 6th IFAC Symposium on Fault Detection Supervision and Safety for Technical Processes. SAFEPROCESS 2006. 30 August - 1 September, 2006. (vol. CD Rom, pp. 943-948). Department of Automation,Tsinghua University School of Automation, Beihang University for the Chinese Association of Automation. BEIJING: IFAC (CHINA).

SIMANI S., FANTUZZI, C. (2006). PWA Dynamic Identification for Nonlinear Model Fault Detection. In: Proceedings of the SAFEPROCESS 2006 - 6th IFAC Symposium on Fault Detection Supervision and Safety for Technical Processes. SAFEPROCESS 2006. 30 August - 1 September, 2006. (vol. CD Rom, pp. 1189-1194). Department of Automation,Tsinghua University School of Automation,

Beihang University for the Chinese Association of Automation. BEIJING: IEEE CSS (CHINA).

SIMANI S. (2005). Chemical System Dynamic Identification with Application to Sensor Fault Detection. In: Proceedings of the 16th IFAC World Congress - International Federation of Automatic Control. 2005 IFAC World Congress. July 3-8, 2005. (vol. CD Rom, pp. 1-6). ISBN/ISSN: 008045108X. DVD Proceedings: Paper ID: 1458. PRAGUE: Elsevier Science Ltd. (CZECH REPUBLIC).

SIMANI S., DIVERSI R. (2005). Residual Function Design for Linear Multivariable Systems. In: Proceedings of the 16th 2005 IFAC World Congress - International Federation of Automatic Control. 2005 IFAC World Congress. July 3-8, 2005. (vol. 1, pp. 1-6). ISBN/ISSN: 008045108X. DVD Proceedings. Paper ID: 1465. PRAGUE: IFAC (CZECH REPUBLIC).

SIMANI S., DIVERSI ROBERTO, SOVERINI UMBERTO. (2005). Identification of residual generators for fault detection of linear dynamic models. In: Proceedings of the 44th IEEE Conference on Decision and Control, and the European Control Conference 2005. CDC 2005 - ECC 2005. 12 - 15 December, 2005. (vol. 7, pp. 7651-7655). Interactive Paper. SEVILLE: IEEE CSS (SPAIN).

SIMANI S., FANTUZZI CESARE. (2005). Approximation of Nonlinear Systems with Identified Hybrid Models. In: Proceedings of the 16th 2005 IFAC World Congress - International Federation of Automatic Control. 2005 IFAC World Congress. July 3-8, 2005. (vol. 1, pp. 1-6). ISBN/ISSN: 008045108X. DVD Proceedings. Paper ID: 1470. PRAGUE: IFAC (CZECH REPUBLIC).

SIMANI S. (2004). Hybrid model identification for fault diagnosis of nonlinear dynamic processes. In: Proceedings of the 2004 ACC - American Control Conference. ACC 2004. June 30 - July 2, 2004. (vol. 3, pp. 2445-2450). BOSTON, MA: IEEE (UNITED STATES). SIMANI S. (2004). Identification of a Chemical Process for Fault Detection Application. In: Proceedings of the 2004 ACC - Anerican Control Conference. ACC 2004. June 30 - July 2, 2004. (vol. 4, pp. 4885-4890). BOSTON, MA: IEEE (UNITED STATES).

SIMANI S., BONFE' MARCELLO, CASTALDI PAOLO, GERI WALTER. (2004). Residual Generator Function Design for Actuator Fault Detection and Isolation of a Piper PA30 Aircraft. In: Proceedings of the 43rd CDC 2004 IEEE Conference on Decision and Control. CDC 2004. 14-17 December, 2004. (vol. 4, pp. 4336-4341). ATLANTIS, PARADISE ISLAND: IEEE CSS (BAHAMAS).

SIMANI S., DIVERSI ROBERTO. (2004). Residual Generation Design for Dynamic System Fault Detection. In: Proceedings of the 43rd CDC 2004 IEEE Conference on Decision and Control. CDC 2004. 14-17 December, 2004. (vol. 4, pp. 4311-4315). ATLANTIS, PARADISE ISLAND: IEEE CSS (BAHAMAS).

43. **Authorise Member States and the States associated to the framework programmes to access the data submitted by you?***	yes