

## Giarré Laura

Dipartimento di Ingegneria dell'Automazione e dei Sistemi  
Università di Palermo  
Viale delle Scienze  
Palermo, Italy 90128  
Tel. 39-3283173773  
[giarre@unipa.it](mailto:giarre@unipa.it)

### Education:

|               |      |                       |                |
|---------------|------|-----------------------|----------------|
| PhD           | 1992 | Università di Bologna | Bologna, Italy |
| Laurea degree | 1986 | Università di Firenze | Firenze, Italy |

### Professional History

|               |                                       |                     |
|---------------|---------------------------------------|---------------------|
| 1998- present | Università di Palermo, Palermo, Italy | Associate Professor |
| 1993-1999     | Politecnico di Torino, Torino, Italy  | Assistant Professor |
| 1989-1992     | Università di Firenze, Firenze, Italy | Research Engineer   |
| 1986-1988     | Autostrade spa, Roma, Italy           | Research Engineer   |

### Professional activities

2006- Member of the CSS Technical committee on Identification and Adaptive Control

2004-2006: Coordinator for the University of Palermo of the thematic project: "ESTIA-NET Opening up Electrical Engineering, Computer Technologies and Applied Sciences to Successful Women Careers".

2006 - Invited lecturer at the International DISC Summer school on "Identification and Control of LPV systems", Veldhoven, The Netherlands.

### Committees:

---

|           |  |
|-----------|--|
| 2007      | Member of the International Program Committee, III Conference on Interdisciplinary Education   |
| 2006      | Member of the International Program Committee, IEEE Mediterranean Conference on Control and Automation.                              |
| 2006      | Member of the International Program Committee, II Conference on Interdisciplinary Education  |
| 2006      | Member of the International Program Committee, IEEE Second International Symposium on Communications, Control and Signal Processing. |
| 2002      | Co-Organizer of The Mohammed Dahleh Symposium  |
| 2001-2006 | Associate editor, Systems and Control Letters  |
| 2000      | Member of the International Program Committee, IFAC Symposium on System Identification.  |

### MAIN RESEARCH CONTRIBUTION:

Professor Laura Giarré has developed a comprehensive methodology for the robust identification and modeling of systems under unknown but bounded disturbances and model uncertainty. Her innovative work in the H-infinity approach to identification for robust control and the model

selection is well known and it is widely recognized. Her theoretical breakthrough inspired the subsequent development of similar methodologies within the popular H-infinity framework. Giarré's results are powerful because of the generality and simplicity of the derived methodology. The model selection is based on the quality of the model in term of predictability and it is based on the size of the uncertainty set. She has applied the set membership identification framework and the analysis and modeling of uncertainty to various applicative and innovative fields, such as the Atomic Force Microscope. Giarré expanded the robust identification theory also to time-varying systems and nonlinear systems. She has first solved the problem of Linear Parameter Varying (LPV) identification. The contribution is one of the few available in literature and it has been employed in aeronautic, power systems, jet-turbine and also communications applications. She expanded classical identification scheme both for LPV systems and for a particular class of nonlinear systems such as Hammerstein and Wiener, cascade systems of a static nonlinearity with a linear part she developed a method to first computing the Chebichev conditional center and second to evaluating the Feasible Parameter Set. As shown by the high quality level of citations of her work, the applicability and utility of the various identification techniques developed is provided for a broad area of applications. Professor Giarré has recently also introduced a novel identification, validation and model reduction procedure to be applied in Systems Biology for positive systems. A third fundamental contribute of Giarré has been in the area of Network Agents and Consensus Protocols, where she developed distributed linear and nonlinear algorithm for switching networks with noise, with applications to inventory systems and congestion games. Her innovative contribute stands in the reformulation of the problem along a game theoretical approach, with an interdisciplinary point of view that cross various fields.

### **Main publications:**

#### **PART I: Optimal Control**

E. Mosca, A. Casavola, and L. Giarré.  
Minimax LQ stochastic tracking and servo problems.  
IEEE Transactions on Automatic Control, Vol. 35, n.1, 95-97, 1990.

E. Mosca, L. Giarré, and A. Casavola.  
On the polynomial equations for the MIMO LQ stochastic regulator.  
IEEE Transactions on Automatic Control, Vol. 35, n.3, 320-322, 1990.

E. Mosca and L. Giarré.  
A polynomial approach to MIMO LQ servo and disturbance rejection problems.  
Automatica, Vol. 28, n.1, 209-213, 1992.

*These three papers solve the polynomial approach for LQ tracking, servo and disturbance rejections problems in a stochastic setting, reformulating the solution in terms of diofantine equations.*

D. Bauso, L. Giarré, R. Pesenti.  
Non-linear protocols for optimal distributed consensus in networks of dynamic agents  
Systems and Control Letters, Vol. 55, n.11, 918-928, 2006.

*This last paper introduces a distributed consensus not only for averaging agreement function, but also for any order  $p$  norm agreement. The problem is also reformulated in terms of mechanism design, when the agents are said what to aim instead of what to do.*

## **PART II: Identification**

### **a. Stochastic Identification**

L. Giarré and E. Mosca.  
Implicit predictive adaptive controller with stochastic gradient identifiers.  
IEEE Transaction on Automatic Control, Vol.38, n.7, 1135-1139, 1993.

L. Chisci, L. Giarré, and E. Mosca.  
Indirect and implicit adaptive predictive control of a benchmark plant.  
Automatica, Vol. 30, n.4, 577-584, 1994.

L.Chisci, L. Giarré, and E. Mosca.  
Sidestepping the positive real condition in RELS via multiple RLS identifiers. Automatica, Vol. 29, n.4, 1145-1148, 1993.

*These three papers consider the recursive least square algorithms for adaptive and multi-predictive control scheme.*

B. Bamieh, L. Giarré  
Identification of linear parameter varying models.  
Int. Journal of Robust and Nonlinear Control, Vol. 2, n.9, 841-853, 2002.

*Here the identification of linear parameter varying models is solved. This identification problem has been reduced to a linear regression, and compact formulae for the corresponding least mean square and recursive least-squares algorithms have been provided together with persistency of excitation conditions.*

### **b. Identification for robust control**

L. Giarré, M. Milanese  
H-infinity identification and model structure selection  
Int. Journal of Robust and Nonlinear Control, Vol. 6, n.4, 367-377, 1996.

L. Giarré, M. Milanese, and M.Taragna.  
H\_infinity identification and model quality evaluation.  
IEEE Transaction on Automatic Control, Vol. 42, 188-199, 1997.

L. Giarré, M. Milanese.  
SM identification of approximating models for H\_infinity robust control.  
Int. Journal of Robust and Nonlinear Control, Vol. 9, 319-332, 1999.

*In these papers the set membership H-infinity identification is investigated using time-domain data and mixed parametric and nonparametric models as well as supposing power bounded measurement errors. The problem of optimally estimating the unknown parameters and evaluating the minimal worst case identification error, called radius of information, is solved.*

L. Giarré, B. Kacwicz, and M. Milanese.  
Model quality evaluation in set membership identification,  
Automatica, Vol. 33, 1133-1139, 1997.

L. Giarré and M. Milanese.  
Model quality evaluation in H\_2 identification.  
IEEE Transaction on Automatic Control, Vol. 42, 691-698, 1997.

*From corrupted input-output measurements, the identification of systems that do not necessarily belong to the model class used is investigated in these two papers. This leads to a nonstandard set membership (SM) identification problem. The 'goodness' of different model classes is measured by the conditional radius of information, a generalization of the radius in standard SM identification theory, giving a measure of the minimal worst-case modeling error. Upper and lower bounds on the radius are derived for linearly parameterized model classes. Specific formulas for the upper and lower bounds are given for the case of H-2 identification of exponentially stable systems in the presence of power-bounded noise.*

A. Garulli, L. Giarré and G. Zappa.  
Identification of approximated Hammerstein models in a worst-case setting,  
IEEE Trans. on Automatic Control, Vol. 47, 2046-2050, 2002.

P. Falugi, L. Giarré and G. Zappa.  
Approximation of the Feasible Parameter Set in worst-case identification of Hammerstein models.  
Automatica, Vol. 41, n.6, 1017-1024, 2005.

*The identification of Hammerstein models for nonlinear systems is considered in a worst-case setting, assuming, unknown-but-bounded measurement noise. A new approach is proposed in which the identification of a low-complexity Hammerstein model amounts to the computation of the Chebichev center of a set of matrices conditioned to the manifold of rank-one matrices. The approximation of the Feasible Parameter Set is also solved.*

### **PART III: Identification and its applications**

M. Basso, L. Giarré, M. Dahleh and I. Mezić.  
Complex Dynamics in a Harmonically Excited Lennard-Jones Oscillator: Microcantilever Sample Interaction in Scanning Probe Microscopes.  
ASME J. of Dynamic Systems, Measurement and Control, Vol. 122, 240-245, 2000.

*In this paper we model the microcantilever-sample interaction in an atomic force microscope (AFM) via a Lennard-Jones potential and consider the dynamical behavior of a harmonically forced system. Using nonlinear analysis techniques on attracting limit sets, we numerically verify the presence of chaotic invariant sets.*

M. Basso, L. Giarré, S. Groppi, G. Zappa.  
NARX Models of an Industrial Power Plant Gas Turbine.  
IEEE Trans on Control Technology, Vol. 13, no.4, 599-605, 2005.  
*The experience with the identification of a nonlinear autoregressive with exogenous inputs (NARX) model for the PGT10B1 power plant gas turbine manufactured by General Electric-Nuovo Pignone has been reported in this paper.*

L. Giarré, D. Bauso, P. Falugi and B. Bamieh.  
LPV Model Identification for Gain Scheduling Control: an application to stall and surge control.  
Control Engineering Practice, 14(4): 351-361, 2006.

*Here, we approach the problem of identifying a nonlinear plant by parametrizing its dynamics as a linear parameter varying model. The system under consideration is the Moore Greitzer model which captures surge and stall phenomena in compressors.*

### **BOOK**

L. Giarré and B. Bamieh Eds.  
MULTIDISCIPLINARY RESEARCH IN CONTROL  
LECTURE NOTES IN CONTROL AND INFORMATION SCIENCES 289: 3-14 2003.