

Curriculum Vitae

INFORMAZIONI PERSONALI

Nome LUCA
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FORMAZIONE TITOLI

EDUCATION

- 1998: Master degree (Italian Laurea) in Electronic Engineering (*cum laude*) at the University of Padova, Italy
- 2003: PhD degree in Electronic Devices at the University of Trento, Italy

PROFESSIONAL EXPERIENCE

1 Work Experience

- 1999-2000: Research Fellow on system identification and modeling at the Medical Biophysics Division of ITC-irst (Institute for Scientific and Technologic Research), Trento, Italy
- 2000-2003: PhD student at the Department of Physics, University of Trento, Italy
- 2003-2008: Postdoctoral Fellow at the Biophysics and Biosignals Laboratory of the Department of Physics, University of Trento, Italy
- 2008-2013: Postdoctoral Fellow at the interdepartmental Center for Biotechnologies (BIOTech) of the University of Trento, Italy
- 2014-2017: Researcher, Healthcare Research and Innovation Program, Bruno Kessler Foundation (FBK), Trento, Italy
- 2018-present: Associate Professor, Department of Energy, Information engineering and Mathematical models (DEIM), University of Palermo, Italy

2 Funded Research Stays Abroad

- May-Jul 2007: Appointed Research Fellow, Dept. of Biomedical Engineering, State University of New York, Stony Brook, NY, USA (working with Prof. Ki H. Chon)
- Sep-Dec 2010: Visiting Researcher (US Navy Research Grant N0001409WX20220), Dept. of Biomedical Engineering, Worcester Polytechnic Institute, Worcester, MA, USA (working with Prof. Ki H. Chon)
- Mar-Jun 2013: Visiting Researcher (Special Research Grant, Flanders Research Foundation), Dept. of Data Analysis, Faculty of Psychological and Pedagogical Sciences, Gent, Belgium (working with Prof. D. Marinazzo)
- Apr-May 2015: Visiting Researcher ("Science without borders" Research Grant), Dept. of Electronic Engineering, Federal University of Minas Gerais, Belo Horizonte, Brazil (working with Prof. A. Beda)
- Apr-Jul 2016: Visiting Researcher ("FBK Mobility Program" Research Grant), Dept. of Physics, Boston University, Boston, MA, United States (working with Prof. P. Ch. Ivanov)

ATTIVITA' DIDATTICA

ACADEMIC ACTIVITY

- 2016-2017: Member of the Doctorate in Cognitive and Brain Sciences Committee, CiMeC, University of Trento, Italy
- 2018: Member of The Organizing Committee of the Degree in Biomedical Engineering, University of Palermo, Italy

1 Teaching Activity

- 1999-2005: teaching assistant of General Physics II at the Engineering Faculty of the University of Trento, Italy (academic years: from 1999/2000 to 2004/2005)
- 2002-2007: teaching assistant of Signal and Image Processing for Clinical Diagnostics at the graduation course in Physics and Biomedical technologies of the University of Trento, Italy (academic years: from 2002/2003 to 2006/2007)
- 2015: Faculty of Electronic Engineering, Federal University of Minas Gerais, Belo Horizonte, Brazil, short course (10 hours) on Information theory and time series analysis, April 2015
- 2016: Lesson on "Network Physiology" for the Massive Open Online Course (MOOC) 'A Primer on Health Technology Development for Smart City' of the IEEE.

- 2017: Center of Mathematics of the University of Porto (CMUP), Portugal, 1-day Workshop on Signal Processing and Data Analysis, on the topic "Information theory for the analysis of physiological time series", Oct 13, 2017

2 Lectures and Seminars

- Jun 18, 2001: Department of Physics, University of Trento, *Seminari di aggiornamento di Biofisica e Biosegnali* – seminar lecture
- May 28, 2002: Università di Padova, *Corso di Tecnologie Biomediche* – seminar lecture
- Feb 11, 2003: Department of Physics, University of Trento, *Seminari di aggiornamento di Biofisica e Biosegnali* – seminar lecture
- Jun 1, 2007: Faculty of Biomedical Engineering of the State University of New York; Stony Brook, NY, USA – invited seminar lecture
- Nov 2008: Department of Physics, University of Trento, *Experimental Workshop of the Department of Physics* – seminar lecture
- 2009: Department of Biomedical Engineering of the University of Lund; Lund, Sweden, Nov 11, 2009 – invited seminar lecture
- Nov 19, 2010: Department of Biomedical Engineering of the Worcester Polytechnic Institute; Worcester, MA, USA – invited seminar lecture
- Apr 14, 2011: CiMeC, University of Trento, *EEG lab seminars* – seminar lecture
- Mar 18, 2013: Faculty of Psychological and Pedagogical Sciences; Gent, Belgium – invited seminar lecture
- Jul 15, 2016: Department of Physics, Boston University; Boston, MA, USA – invited seminar lecture
- Jul 7, 2017: School of Systems Science, Beijing Normal University, Beijing – invited seminar lecture

3 Supervision/tutoring of PhD Students

- 2009-2012: Silvia Erla, supervision of the PhD in Cognitive Neuroscience, University of Trento, Italy; her thesis "Computational methods for the assessment of brain connectivity" has been awarded with the prize of best PhD thesis of 2012 in Cognitive Neuroscience at the University of Trento
- 2010: Ulrike Richter, University of Lund, Sweden, tutoring during PhD research stage at the BIOtech Center of the University of Trento (4 months)
- 2013-2016: co-supervisor of Alessandro Montalto, PhD student at the Faculty of Psychological and Pedagogical Sciences, University of Gent, Belgium (visiting stage: 3 months in 2016)
- 2014: Alejandro Alcaine Otin, University of Zaragoza, Spain, tutoring during PhD research stage at the BIOtech Center of the University of Trento (4 months)
- 2015: Dorota Wejer, University of Gdansk, Poland, tutoring during PhD research stage at the BIOtech Center of the University of Trento (1 month)
- 2015-2016: co-supervisor of Josè Melo, master student at the Federal University of Minas Gerais, Belo Horizonte, Brazil
- 2016: Wanting Xiong, Normal University of Beijing, China, tutoring during PhD research stage at the Department of Physics of Boston University, MA, USA (3 months)

4 Supervision/tutoring of Master Students

- 2003: Chiara Gasperi, Laurea in Fisica, University of Trento, Italy
- 2003: Roberta Cucino, Laurea in Ingegneria dei Sistemi, Politecnico di Milano, Italy
- 2004: Alessandro Cristoforetti, Laurea in Fisica, University of Trento, Italy
- 2005: Emanuele Zivelonghi, Laurea in Fisica, University of Trento, Italy
- 2005: Daniele Scarpari, Laurea Specialistica in Ingegneria delle Telecomunicazioni, University of Trento, Italy
- 2008: Silvia Erla, Laurea Specialistica in Fisica e Tecnologie Biomediche, University of Trento, Italy
- 2008: Susanne Greiner, Laurea Specialistica in Fisica e Tecnologie Biomediche, University of Trento, Italy
- 2012: Lucia Schiatti, Laurea Specialistica in Ingegneria Meccatronica, University of Trento, Italy
- 2013: Simone D'Amario, Laurea Magistrale in Scienze Cognitive, University of Trento, Italy
- 2016: Mauro Paganini, Laurea in Fisica, University of Trento, Italy
- 2017: Martina Valente, Laurea Magistrale in Ingegneria delle Telecomunicazioni, University of Trento, Italy
- 2018: Viviana Lo Giudice, Laurea in Ingegneria Elettronica, University of Palermo

RICERCHE FINANZIATE

Funding Information

- 2001: Participant, IV Programma Quadro - Progetto EPIMEDICS 2001 - "Enhanced, Personal, Intelligent and Mobile system for Early Detection and Interpretation of Cardiological Syndromes" (36 months)
- 2005: Co-Investigator, Provincia Autonoma di Trento - Commissione Ricerca Scientifica 2005 - "The combined role of visual attention and stochastic resonance on human perception" (12 months)
- 2005: Co-Investigator, Progetti di Ricerca Tecnologica Applicata 2005, Fondazione Cassa di Risparmio di Trento e Rovereto - "Integrazioni di immagini multimodali in cardiologia interventistica per il trattamento con ablazione della fibrillazione atriale permanente" (30 months)
- 2007: Co-Investigator, Progetto Industriale SIMMPAC 2007 - "Sistema di monitoraggio multiparametrico per la gestione integrata di pazienti e soggetti ad alto rischio di malattia cardiovascolare" (24 months)

- 2008: Co-Investigator, Bando FIRB "Futuro in Ricerca" 2008 – "Cardiorespiratory dysregulation in hypertensive cardiomyopathy and chronic obstructive pulmonary disease: a nonlinear signal processing approach to diagnostics, optimizing mechanical ventilation and reducing peri- and postoperative morbidity" (36 months)
- 2015: UNCAP - Participant with Bruno Kessler Foundation (FBK, Trento Italy), H2020-PHC-2014 "Advancing active and healthy ageing with ICT: ICT solutions for independent living with cognitive impairment partner institution", project: "Ubiquitous iNteroperable Care for Ageing People" (24 months)
- 2013: Coordinator, Project Unit "Physiological and clinical data analysis" – Healthcare Research Implementation Program (IRCS), Special Program activated by the Autonomous Province of Trento, Italy (36 months)
- 2015: Task Leader, Co-Investigator, Bando Progetti di Ricerca 2014 of the University of Trento – "Of bees and men: Development of an optogenetic animal model to study oscillatory neural networks", project involving the Center of Mind/Brain sciences (CIMeC), Center of Integrative Biology (CIBIO), Department of Physics and Dept. of Industrial Engineering of the University of Trento (18 months)

INCARICHI / CONSULENZE

Scientific Evaluator

Grant reviewer activity

- 2011: *Research Program University-Region 2010-2012- Regione Emilia-Romagna, Italy*
- 2014, 2015: *Postdoctoral Fellow grant applications, The Research Foundation – Flanders (FWO), Belgium*
- 2017: US National Science Foundation (NSF), *evaluator of research proposals in the field of Neuroscience*

Degree examination board

- 2015: External member, Examination Committee – PhD candidate: Devy Widjaja, KU Leuven, Belgium
- 2017: External referee, PhD program in Computer Science, University of Milan, Italy
- 2017: External referee, PhD program "Automatica, Bioingegneria e Ricerca Operativa", University of Rome Sapienza, Italy

ASSOCIAZIONI SCIENTIFICHE

Subscription to Scientific Societies

- 2003-present: Italian Society of Chaos and Complexity, Member
- 2007-present: IEEE Engineering in Medicine and Biology Society, Member
- 2014-present: European Study Group on Cardiovascular Oscillations (ESGCO), Board Member

PUBBLICAZIONE

PUBLICATIONS (data updated on January 2018)

- Total Publications: **180**
 Book Chapters: **6** (first author: 4)
 Articles in Peer-reviewed indexed Journals: **90** (first author: 39; last author: 10)
 Articles in peer-reviewed indexed Conference Proceedings: **51** (first author: 24)
 Other articles in Conference Proceedings: **22** (first author: 11)
 Abstracts in indexed Journals: **13** (first author: 2)
 - Co-Author (with A. Porta) of the book "Information Theory for Time Series Analysis", in preparation (to be published in 2018 by Cambridge University Press)
 - Bibliometric indexes from Scholar Database:
 total citations received: **2485**
 Hirsch Index: h=**31**
 i10-index (papers cited more than 10 times): **58**
 - Bibliometric indexes from Scopus Database:
 total citations received: **1796**
 citing articles: **1009**
 Hirsch Index: h=**25**
 - Cumulative impact factor of published papers at the year of publication: **204,3** (font: Journal Citation Reports)
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A. Book Chapters

1. F Ravelli, **L Faes**, V Corino, L Mainardi: 'Organization measures of atrial activity during fibrillation', in *Understanding Atrial Fibrillation. The Signal Processing Contribution*; L Mainardi, L Sornmo, S Cerutti (eds); Morgan & Claypool, 2008; pp. 127-150.
2. **L Faes**, G Nollo, 'Multivariate frequency domain analysis of causal interactions in physiological time series', in *Biomedical Engineering, Trends in Electronics, Communications and Software*; AN Laskovski (ed); INTECH, 2011; pp. 403-428. ISBN: 978-953-307-475-7. DOI: 10.5772/13065
3. **L Faes**, 'Assessing connectivity in the presence of instantaneous causality', in *Methods in Brain Connectivity Inference through Multivariate Time Series Analysis*; L Baccalà, K Sameshima (eds); CRC press, Taylor and Francis; 2014, pp. 87-112. ISBN: 9781439845721. DOI: 10.1201/b16550-8
4. **L Faes**, A Porta, 'Conditional entropy-based evaluation of information dynamics in physiological systems', in *Directed Information Measures in Neuroscience*, R Vicente, M Wibral, J Lizier (eds), Springer-Verlag; 2014, pp. 61-86; ISBN: 978-3-642-54473-6; DOI: 10.1007/978-3-642-54474-33
5. A Porta, **L Faes**, G Nollo, ACM Takahashi, AM Catai: 'Influences of aging on cardiovascular control evaluated through a model-free approach to the assessment of complexity and causality', in *ECG Time Series Variability Analysis: Engineering and Medicine*; H Jelinek, D Conforth, A Khandoker, (eds), CRC Press; 2017, pp. 117-140; ISBN: 978-1-4822-4347-5; DOI: 10.1201/9781315372921
6. **L Faes**, G Nollo, A Porta: 'Information decomposition: a tool to break down cardiovascular and cardiorespiratory complexity', *Complexity and Nonlinearity in Cardiovascular Signals*, R Barbieri, EP Scilingo, G Valenza, (eds), Springer; 2017, pp. 87-113; ISBN: 978-3-319-58708-0; DOI: 10.1007/978-3-319-58709-7

B. Articles in Peer-reviewed indexed journals

1. G Nollo, A Porta, **L Faes**, M Del Greco, M Disertori, F Ravelli: 'Causal linear parametric model for baroreflex gain assessment in patients with recent myocardial infarction', *Am J Physiol Heart Circ Physiol* 2001;280:H1830-H1839.
2. **L Faes**, G Nollo, M Kirchner, E Olivetti, F Gaita, R Riccardi, R Antolini: 'Principal component analysis and cluster analysis for measuring the local organisation of human atrial fibrillation', *Med Biol Eng Comput* 2001;39:656-663.
3. G Nollo, **L Faes**, A Porta, B Pellegrini, F Ravelli, M Del Greco, M Disertori, R Antolini: 'Evidence of unbalanced regulatory mechanism of heart rate and systolic pressure after acute myocardial infarction', *Am J Physiol Heart Circ Physiol* 2002;83:H1200-H1207.
4. **L Faes**, G Nollo, R Antolini, F Gaita, F Ravelli: 'A method for quantifying atrial fibrillation organization based on wave morphology similarity', *IEEE Trans Biomed Eng* 2002;49:1504-1513.
5. **L Faes**, G Nollo, R Antolini: 'Experimental approach for testing the uncoupling between cardiovascular variability series', *Med Biol Eng Comput* 2002;40:565-570.
6. **L Faes**, GD Pinna, A Porta, R Maestri, G Nollo: 'Surrogate data analysis for assessing the significance of the coherence function', *IEEE Trans Biomed Eng* 2004;51(7):1156-1166.
7. **L Faes**, A Porta, R Cucino, S Cerutti, R Antolini, G Nollo: 'Causal transfer function analysis to describe the closed loop interactions between cardiovascular and cardiorespiratory variability signals', *Biol Cybern* 2004;90(6):390-399.
8. B Pellegrini, **L Faes**, G Nollo, F Schena: 'Quantifying the contribution of arm postural tremor to the outcome of goal-directed pointing task by displacement measures', *J Neurosci Methods* 2004;139:185-193.
9. G Nollo, **L Faes**, A Porta, R Antolini, F Ravelli: 'Exploring directionality in spontaneous heart period and systolic pressure variability interactions in humans. Implications in the evaluation of the baroreflex gain', *Am J Physiol Heart Circ Physiol* 2005;288(4):H1777-H1785.
10. F Ravelli, **L Faes**, L Sandrini, F Gaita, R Antolini, M Scaglione, G Nollo 'wave similarity mapping shows the spatiotemporal distribution of fibrillatory wave complexity in the human right atrium during paroxysmal and chronic atrial fibrillation', *J Cardiovasc Electrophysiol* 2005;16:1071-1076.
11. M Masè, **L Faes**, R Antolini, M Scaglione, F Ravelli 'Quantification of synchronization during atrial fibrillation by Shannon entropy: validation in patients and computer model of atrial arrhythmias', *Physiol Meas* 2005;26:911-923.
12. **L Faes**, L Widesott, M Del Greco, R Antolini, G Nollo: 'Causal cross-spectral analysis of heart rate and blood pressure variability for describing the impairment of the cardiovascular control in neurally mediated syncope', *IEEE Trans Biomed Eng* 2006;53:65-73.
13. **L Faes**, G Nollo: 'Bivariate nonlinear prediction to quantify the strength of complex dynamical interactions in short-term cardiovascular variability', *Med Biol Eng Comput* 2006;44(5):383-392.
14. **L Faes**, R Cucino, G Nollo: 'Mixed predictability and cross-validation to assess nonlinear Granger causality in short cardiovascular variability series', *Biomedizinische Technik (Biomedical Engineering)* 2006;51(4):255-259.
15. F Ravelli, M Mase, M Del Greco, **L Faes**, M Disertori: 'Deterioration of organization in the first minutes of atrial fibrillation: a beat-to-beat analysis of cycle length and wave similarity', *J Cardiovasc Electrophysiol* 2007;18(1):60-65.
16. **L Faes**, G Nollo, F Ravelli, L Ricci, M Vescovi, M Turatto, F Pavani, R Antolini: 'Small-sample characterization of stochastic approximation staircases in forced-choice adaptive threshold estimation', *Perception & Psychophysics* 2007;69(2):254-262.
17. A Porta, **L Faes**, M Masè, G D'Addio, GD Pinna, R Maestri, N Montano, R Furlan, S Guzzetti, G Nollo, A Malliani: 'An integrated approach based on uniform quantization for the evaluation of complexity of short-term heart period variability: application to 24h Holter recordings', *Chaos* 2007;17(1):015117.

18. **L Faes**, F Ravelli: 'A morphology-based approach to the evaluation of atrial fibrillation organization', *IEEE Eng Med Biol Mag* 2007;26(4):59-67.
19. A Cristoforetti, M Masè, **L Faes**, M Centonze, M Del Greco, R Antolini, G Nollo, F Ravelli: 'A stochastic approach for automatic registration and fusion of left atrial electroanatomic maps with 3D CT anatomical images', *Phys Med Biol* 2007;52(20):6323-6337.
20. A Cristoforetti, **L Faes**, F Ravelli, M Centonze, M Del Greco, R Antolini, G Nollo: 'Isolation of the left atrial surface from cardiac multi-detector CT images based on marker controlled watershed segmentation', *Med Eng Phys* 2008;30(1):48-58.
21. **L Faes**, G Nollo, K H Chon: 'Assessment of Granger causality by nonlinear model identification: application to short-term cardiovascular variability', *Ann Biomed Eng* 2008;36(3):381-395.
22. G Nollo, M Marconcini, **L Faes**, F Bovolo, F Ravelli, L Bruzzone: 'An Automatic system for the analysis and the classification of human atrial fibrillation patterns from intracardiac electrograms', *IEEE Trans Biomed Eng* 2008;55(9):2275-2285.
23. Y Bai, KL Siu, S Ashraf, **L Faes**, G Nollo, KH Chon: 'Nonlinear coupling is absent in acute myocardial patients but not healthy subjects', *Am J Physiol Heart Circ Physiol* 2008;295(2):H578-586.
24. **L Faes**, A Porta, G Nollo: 'Mutual nonlinear prediction as a tool to evaluate coupling strength and directionality in bivariate time series: Comparison among different strategies based on k nearest neighbors', *Phys Rev E* 2008;78:026201.
25. G Nollo, **L Faes**, R Antolini, A Porta: 'Assessing causality in normal and impaired short-term cardiovascular regulation via nonlinear prediction methods', *Phil Trans R Soc A* 2009;367:1423-40.
26. **L Faes**, Ki H Chon, G Nollo: 'A method for the time-varying nonlinear prediction of complex nonstationary biomedical signals', *IEEE Trans Biomed Eng* 2009;56(2):205-209.
27. **L Faes**, H Zhao, Ki H Chon, G Nollo: 'Time-varying surrogate data to assess nonlinearity in nonstationary time series: application to heart rate variability', *IEEE Trans Biomed Eng* 2009;56(3):685-695.
28. S Erla, **L Faes**, E Tranquillini, D Orrico, G Nollo: 'Multivariate autoregressive model with instantaneous effects to improve brain connectivity estimation', *Int J Bioelectromag* 2009; 11(2):74-79.
29. **L Faes**, A Porta, G Nollo: 'Testing frequency domain causality in multivariate time series', *IEEE Trans Biomed Eng* 2010; 57(8):1897-1906.
30. **L Faes**, G Nollo: 'Assessing frequency domain causality in cardiovascular time series with instantaneous interactions', *Meth Inf Med* 2010; 49(5):453-457.
31. S Erla, **L Faes**, G Nollo: 'Quantifying changes in EEG complexity induced by photic stimulation', *Meth Inf Med* 2010; 49(4):496-500.
32. **L Faes**, G Nollo: 'Extended causal modeling to assess Partial Directed Coherence in multiple time series with significant instantaneous interactions', *Biol Cyb* 2010; 103:387-400.
33. U Richter, **L Faes**, A Cristoforetti, M Masè, F Ravelli, M Stridh, L Sörnmo: 'A novel approach to propagation patterns analysis in intracardiac atrial fibrillation signals', *Ann Biomed Eng* 2011; 39(1):310-323. DOI: 10.1007/s10439-010-0146-8
34. S Erla, **L Faes**, E Tranquillini, D Orrico, G Nollo: 'k-nearest neighbour local linear prediction for quantifying EEG complexity during intermittent photic stimulation', *Med Eng Phys* 2011; 33(4):504-512. DOI: 10.1016/j.medengphy.2010.12.003
35. M Masè, W Mattei, R Cucino, **L Faes**, G Nollo: 'Feasibility of cuff-less measurement of systolic and diastolic arterial blood pressure', *J Electrocardiol* 2011; 44:201-207. DOI: 10.1016/j.jelectrocard.2010.11.019
36. **L Faes**, G Nollo, A Porta: 'Information-based detection of nonlinear Granger causality in multivariate processes via a nonuniform embedding technique', *Phys Rev E*; 2011; 83(5 Pt 1):051112. DOI: 10.1103/PhysRevE.83.051112
37. **L Faes**, G Nollo, A Porta: 'Information domain approach to the investigation of cardio-vascular, cardio-pulmonary and vasculo-pulmonary causal couplings', *Front Physiol*, Special Issue "Engineering Approaches to Study Cardiovascular Physiology: Modeling, Estimation, and Signal Processing", 2011; 2:80. DOI: 10.3389/fphys.2011.00080
38. **L Faes**, G Nollo, A Porta: 'Non-uniform multivariate embedding to assess the information transfer in cardiovascular and cardiorespiratory variability series', *Comput Biol Med* 2012; 42:290-297. DOI: 10.1016/j.compbiomed.2011.02.007
39. S Erla, **L Faes**, G Nollo, C Braun, C Papadelis: 'Multivariate EEG Spectral Analysis elicits the functional link between motor and visual cortex during integrative sensorimotor tasks', *Biomed Signal Process Control* 2012; 7:221-227. DOI: 10.1016/j.bspc.2011.08.002
40. U Richter, **L Faes**, F Ravelli, L Sörnmo: 'Propagation pattern analysis during atrial fibrillation based on sparse modeling', *IEEE Trans Biomed Eng* 2012; 59(5):1319-1328. DOI: 10.1109/TBME.2012.2187054
41. **L Faes**, S Erla, G Nollo: 'Measuring connectivity in linear multivariate processes: definitions, interpretation and practical analysis', *Comp Math Methods Med*, special issue on "Methodological Advances in Brain Connectivity", 2012; 140513:18 pages. DOI: 10.1155/2012/140513
42. **L Faes**, S Erla, G Nollo: 'Block partial directed coherence: a new tool for the structural analysis of brain Networks', *Int J Bioelectromag* 2012;14(4):162-166.
43. **L Faes**, RG Andrzejak, M Ding, D Kugiumtzis: 'Methodological Advances in Brain Connectivity', *Comp Math Methods Med*, editorial of the special issue on "Methodological Advances in Brain Connectivity", 2012; 492902:2 pages. DOI: 10.1155/2012/492902
44. A Porta, **L Faes**: 'Assessing causality in brain dynamics and cardiovascular control', *Philosophical Transactions A*, editorial of the special issue on "Causality in Brain Dynamics and Cardiovascular Control", 2013;371:20120517 (5 pages). DOI: 10.1098/rsta.2012.0517
45. **L Faes**, G Nollo, A Porta: 'Compensated transfer entropy as a tool for reliably estimating information transfer in physiological time series', *Entropy*, special issue on "Transfer Entropy", 2013; 15(1):198-219. DOI:10.3390/e15010198. pp. 198-219
46. **L Faes**, G Nollo: 'Measuring frequency domain Granger causality for multiple blocks of interacting time series', *Biol Cyb* 2013; 107:217-232 (DOI 10.1007/s00422-013-0547-5). DOI: 10.1007/s00422-013-0547-5
47. **L Faes**, S Erla, A Porta, G Nollo: 'A framework for assessing frequency domain causality in physiological time series with instantaneous effects', *Philosophical Transactions A*, special issue on "Causality in Brain Dynamics and Cardiovascular Control"; 2013;371:20110618 (21 pages). DOI: 10.1098/rsta.2011.0618

48. A Porta, P Castiglioni, M Di Rienzo, T Bassani, V Bari, M Zanirato, **L Faes**, G Nollo, A Cividjan, L Quintin: 'Cardiovascular control and time domain Granger causality: insight from selective autonomic blockade', *Philosophical Transactions A*, special issue on "Causality in Brain Dynamics and Cardiovascular Control"; 2013;371:20120161 (16 pages). DOI: 10.1098/rsta.2012.0161
49. **L Faes**, A Porta, G Rossato, A Adami, D Tonon, A Corica, G Nollo: 'Investigating the mechanisms of cardiovascular and cerebrovascular regulation in orthostatic syncope through an information decomposition strategy', *Autonomic Neurosci* 2013; 178:76-82. DOI: 10.1016/j.autneu.2013.02.013
50. **L Faes**, M Masè, G Nollo, KH Chon, JP Florian: 'Measuring postural-related changes of spontaneous baroreflex sensitivity after repeated long-duration diving: frequency domain approaches', *Autonomic Neurosci* 2013; 178:96-102. DOI: 10.1016/j.autneu.2013.03.006
51. **L Faes**, G Nollo, A Porta: 'Mechanisms of causal interaction between short-term heart period and arterial pressure oscillations during orthostatic challenge', *J Appl Physiol* 2013;114:1657-1667. DOI: 10.1152/jappphysiol.01172.2012
52. JP Florian, EE Simmons, KH Chon, **L Faes**, B Shykoff: 'Cardiovascular and autonomic responses to physiological stressors before and after six hours of water immersion', *J Appl Physiol* 2013; 115:1275-1289. DOI:10.1152/jappphysiol.00466.2013
53. A Porta, **L Faes**, V Bari, A Marchi, T Bassani, G Nollo, ACM Takahashi, AM Catai, 'Effect of age on complexity and causality of the cardiovascular control: comparison between model-based and model-free approaches', *PLOS One* 2014; 9(2):e89463 (14 pages). DOI: 10.1371/journal.pone.0089463
54. **L Faes**, D Marinazzo, A Montalto, G Nollo, 'Lag-specific transfer entropy as a tool to assess cardiovascular and cardiorespiratory information transfer', *IEEE Trans Biomed Eng* 2014; 61(10):2556-2568. DOI: 10.1109/TBME.2014.2323131
55. **L Faes**, G Nollo, F Jurysta, D Marinazzo, 'Information dynamics of brain-heart physiological networks during sleep', *New J Phys* 2014; 16:105005 (20 pages). DOI: 10.1088/1367-2630/16/10/105005
56. A Montalto, **L Faes**, D. Marinazzo, 'MuTE: a MATLAB toolbox to compare established and novel estimators of the multivariate transfer entropy', *PLOS ONE* 2014; 9(10):e109462 (13 pages). DOI: 10.1371/journal.pone.0109462
57. **L Faes**, A Porta, G Nollo, 'Information decomposition in bivariate systems: theory and application to cardiorespiratory dynamics', *Entropy*, special issue on "Entropy and Cardiac Physics", 2015, DOI:17:277-303. 10.3390/e17010277.
58. **L Faes**, D Kugiumtzis, A Montalto, G Nollo, D Marinazzo, 'Estimating the decomposition of predictive information in multivariate systems', *Phys. Rev. E* 2015; 91:032904. DOI: 10.1103/PhysRevE.91.032904.
59. L Schiatti, G Nollo, G Rossato, **L Faes**, 'Extended Granger causality: a new tool to identify the structure of physiological networks', *Phys. Meas.* 2015; 36:827-843. DOI:10.1088/0967-3334/36/4/827.
60. **L Faes**, D Marinazzo, F Jurysta, G Nollo, 'Linear and nonlinear brain-heart and brain-brain interactions during sleep', *Phys. Meas.* 2015; 36: 683-698. DOI:10.1088/0967-3334/36/4/683.
61. A Porta, G Nollo, **L Faes**, 'Editorial: Bridging the gap between the development of advanced biomedical signal processing tools and clinical practice', *Phys. Meas.* 2015; 36:627-631. DOI:10.1088/0967-3334/36/4/627.
62. C Varon, A Montalto, K Jansen, L Lagae, D Marinazzo, **L Faes**, S Van Huffel, 'Intercal cardiorespiratory variability in temporal lobe and absence epilepsy in childhood', *Phys. Meas.* 2015; 36:845-856. DOI:10.1088/0967-3334/36/4/845.
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8. **L Faes**, S Erla, G Nollo, 'Investigating the impact of instantaneous causality on frequency domain connectivity measures', *Meeting of the Society of Autonomic Neuroscience*, 2011, Thessaloniki, Greece. May 7, 2011. *Neurosci Lett* 2011; 500S:e9.
9. JP Florian, EE Simmons, KH Chon, **L Faes**, BE Shykoff, 'Cardiovascular and autonomic responses to stressors following 6 hours of water immersion', *Experimental Biology 2013 Conference*, 2013, Boston, Usa. April 20-24, 2013. *FASEB J*, 2013; 27:716.2.
10. F Jurysta, **L Faes**, G Nollo, G Loas, D Marinazzo, P Linkowski: 'Study of the dynamic information between heart and brain networks during nocturnal sleep', *22nd Congress of the European Sleep Research Society*, 2014. *J. Sleep Res.* 2014; 23:95.
11. A Montalto, **L Faes**, D Marinazzo: ' MuTE: a freeware, modular toolbox to evaluate Multivariate Transfer Entropy and Artificial Neural Networks Granger causality', *2nd Belgian Neuroinformatics Congress* 2015. *Front. Neuroinf.* 2015; doi: 10.3389/conf.fninf.2015.19.00035.
12. B Graff, D Wejer, **L Faes**, G Graff, D Makowiec, K Narkiewicz: 'The use of transfer entropy method for the assessment of cardiovascular regulation during head-up tilt test', *Autonomic Neurosci* 2015; 192:101-102. doi: 10.1016/j.autneu.2015.07.152.
13. S Stramaglia, **L Faes**, D Marinazzo: 'Information-theoretic framework for measuring brain–heart causal interactions in healthy subjects and patients with sleep disorders', *Proc. of the 18th World Congress of Psychophysiology (IOP2016)*. *Int J Psychophysiol* 2016; 108:52. doi: 10.1016/j.ijpsycho.2016.07.174.

ATTIVITA' SCIENTIFICHE

SCIENTIFIC ACTIVITY

1 Editorial Activity

- 2008-present: Associate Editor for the Signal Processing Theme, *Annual International Conference of the IEEE Engineering in Medicine and Biology Society*
- 2013-2017: Associate Editor, *International Scholarly Research Notices* (former *ISRN Biomedical Engineering*, Hindawi Publishing Corp.)
- 2014-present: Associate Editor, *Computational and Mathematical Methods in Medicine*
- 2014-present: Editorial Board Member, *Frontiers in Computational Physiology and Medicine*
- 2016-present: International Advisory Board Member, *Physiological Measurement*
- 2017-present: Editorial Board Member, *Entropy*

- 2012: Lead Guest Editor, *Computational and Mathematical Methods in Medicine*, Special Issue "Methodological Advances in Brain Connectivity" - <http://www.hindawi.com/journals/cmmm/si/359045/>
- 2013: Guest Editor, *Philosophical Transactions of the Royal Society A*, Special Issue "Assessing Causality in Brain Dynamics and Cardiovascular Control" - <http://rsta.royalsocietypublishing.org/content/371/1997.toc>
- 2015: Guest Editor, *Physiological Measurement*, Special Issue "8th Conference of the European Study Group on Cardiovascular Oscillations, ESGCO 2014" - <http://iopscience.iop.org/0967-3334/page/8th%20ESGCO%202014>

2 Committee Service

- 2008-2015: Program Committee member, and co-chair of the Track on Connectivity and Causality of the Signal Processing Theme, *Annual International Conference of the IEEE Engineering in Medicine and Biology Society*
- 2010: Program Committee member, *MEDICON 2010 - 12th Mediterranean Conference on Medical and Biological Engineering and Computing*, Chalkidiki (Greece), May 27-30, 2010
- 2014: Program Committee member, *BIOSIGNALS 2014 - International Conference on bio-inspired systems and signal processing*, Eseo, Angers, Loire Valley (France), Mar 3-6, 2014
- 2014: Program Chair, Scientific Committee member, *ESGCO 2014 - 8th Conference of the European Study Group on Cardiovascular Oscillations*, Fai della Paganella, Trento (Italy), May 25-28, 2014
- 2014: Program Committee member, *ITISE 2014 - International Work-Conference on Time Series*, Granada (Spain), Jun 25-27, 2014
- 2015: Program Committee member, *BIOSIGNALS 2015 - International Conference on bio-inspired systems and signal processing*, Lisbon (Portugal), Jan 12-15, 2015
- 2015: Program Committee member, *ITISE 2015 - International Work-Conference on Time Series*, Granada (Spain), Jul 1-3, 2015
- 2015: Program Committee member, *AMBN 2015 - Workshop on Advanced Methodologies for Bayesian Networks*, Yokohama (Japan), Nov 16-18, 2015
- 2015: member of the Technical Committee on Biomedical Signal Processing of the IEEE Engineering in Medicine and Biology (EMB) Society
- 2016: Scientific committee member, *ESGCO 2016 – 9th ESGCO meeting and International Conference on Biological Oscillations*, Lancaster (UK), Apr 10-14, 2016
- 2016: Program Committee member, *BIOSIGNALS 2016 – 9th International Conference on bio-inspired systems and signal processing*, Rome (Italy), Feb 21-23, 2016
- 2016: Program Committee member, *MEDICON 2016 - 14th Mediterranean Conference on Medical and Biological Engineering and Computing*, Cyprus, Mar 31 - Apr 2, 2016

- 2016: Program Committee member, *ITISE 2016 - International Work-Conference on Time Series Analysis*, Granada (Spain), Jun 27-29, 2016
- 2017: Program Committee member, *AMBN 2017 - Workshop on Advanced Methodologies for Bayesian Networks*, Kyoto (Japan), Sep 20-22, 2017
- 2017: Program Committee member, 2017 IEEE First Ukraine Conference on Electrical and Computer Engineering (UKRCON) May 29-June 2, 2017
- 2018: Scientific committee member, *ESGCO 2018 – 10th ESGCO meeting and International Conference on Biological Oscillations*, Graz (Aut), Sep , 2018

3 Organization of Conferences and Conference Sessions

- Organizer of the Conference *ESGCO 2014 – 8th Conference of the European Study Group on Cardiovascular Oscillations*, Fai della Paganella, May 25-28, Trento (Italy), International Conference with 145 attendees (<http://events.unitn.it/en/esgco2014>); Program Chair of the Conference and organizer of the revision process of the contributions (125 peer-reviewed papers, indexed as IEEE proceedings)
- Organizer of the Invited Session 'Causality in brain dynamics and cardiovascular control', *33rd International Conference of the IEEE-EMBS (EMBC '11)*, Boston, MA, USA, Sep 3, 2011
- Organizer of the Invited Session 'Model-Free and Non-Linear Interdependence Measures for Neurophysiological and Cardiovascular Time Series Analysis', *34th International Conference of the IEEE-EMBS (EMBC '12)*, San Diego, CA, USA, Aug 30, 2012
- Organizer of the Invited Session 'Entropy-Based Analysis of Physiological Time Series', *35th International Conference of the IEEE-EMBS (EMBC '13)*, Osaka, Japan, Jul 5, 2013
- Organizer of the Session 'Multivariate Analysis of Cardiovascular Variability', *8th Conference of the European Study Group on Cardiovascular Oscillations (ESGCO 2014)*, Trento, Italy, May 27, 2014
- Organizer of the Invited Session 'Advances in Multivariate Physiological Variability Analysis', *36th International Conference of the IEEE-EMBS (EMBC '14)*, Chicago, IL, USA, Aug 29, 2014
- Organizer of three invited sessions at the *37th International Conference of the IEEE-EMBS (EMBC '15)*, Milano, Italy, Aug 25-29, 2015: 'Information Dynamics in Networks of Biomedical Signals'; 'Disentangling Patho-Physiological Mechanisms from Multivariate Cardiovascular Variability Series'; 'Solving the Brain Connectivity Puzzle: Methodological Advancements and Future Challenges'
- Organizer of the Session 'Entropy Measures to Evaluate Dynamics', *International Conference on Biological Oscillations (9th ESGCO meeting 2016)*, Lancaster, UK, Apr 10-14, 2016
- Organizer of the mini-symposium 'Advances in brain connectivity analysis: perspectives and pitfalls', *38th International Conference of the IEEE-EMBS (EMBC '16)*, Orlando, FL, USA, Aug 19, 2016
- Organizer of the Invited Session 'Brain and Physiological Networks: Methods and Applications', *39th International Conference of the IEEE-EMBS (EMBC '17)*, Jeju Island, Korea, Jul 11-15, 2017

4 Participation in Conferences

- Participation with oral presentation in over 50 national and international conferences (in 18 occasions as invited speaker)
- Chairman of Scientific Sessions at international Conferences – 18 chaired sessions
- Chairman of the Workshop *Applied Mathematics in Biosciences, Physics and Engineering*, Gdansk, Poland, Nov 27, 2014
- Co-chair of the Track on Bioengineering & Robotics, *IEEE Ukraine Conference on Electrical and Computer Engineering (UKRCON)*, Kyiv, Ukraine, May 2017

5 International Invited presentations

- Sep 1, 2010 : *32th Annual International Conference IEEE-EMBS*, Buenos Aires, Argentina, session on "Nonlinear Dynamic Analysis of Biomedical Signals" – invited talk
- Sep 1, 2010: *32th Annual International Conference IEEE-EMBS*, Buenos Aires, Argentina, session on "Interactions, Coupling & Synchronizations" – invited talk
- May 7, 2011: *Meeting of the Society of Autonomic Neuroscience*, Thessaloniki, Greece, workshop on "Effective connectivity analysis of the EEG" – invited talk
- Sep 3, 2011: *33th Annual International Conference IEEE-EMBS*, Boston, MA, USA, session on "Causality in Brain Dynamics and Cardiovascular Control" – invited talk
- Apr 27, 2012: *NeFF-Symposium on Non-linear and model-free Interdependence Measures in Neuroscience*, Frankfurt, Germany – invited talk
- Aug 30, 2012: *34th Annual International Conference IEEE-EMBS*, San Diego, CA, USA, session on "Model-Free and Non-Linear Interdependence Measures for Neurophysiological and Cardiovascular Time Series Analysis" – invited talk
- Jul 5, 2013: *35th Annual International Conference IEEE-EMBS*, Osaka, Japan, session on "Entropy-based analysis of physiological time series" – invited talk
- Aug 29, 2014: *36th Annual International Conference of the IEEE-EMBS*, Chicago, USA, session on "Advances in multivariate physiological variability analysis" – invited talk
- Sep 10, 2014: *34th Dynamics Days Europe*, Bayreuth, Germany, workshop on "Multivariate time series, causality and networks" – invited talk
- Nov 27, 2014: Workshop on *Applied Mathematics in Biosciences, Physics and Engineering*, Gdansk, Poland – **invited opening lecture**

- Dec 12, 2014: Workshop on *Neural Information Dynamics, Causality, and Computation near Criticality*, Frankfurt, Germany – invited talk
- Feb 18, 2015: Workshop on *Quantitative Biomedicine for Health and Disease*, Bilbao, Spain – invited talk
- Aug 26, 2015: *37th Annual International Conference of the IEEE-EMBS*, Milano, Italy, session on “Disentangling Patho-Physiological Mechanisms from Multivariate Cardiovascular Variability Series” – invited talk
- Aug 27, 2015: *37th Annual International Conference of the IEEE-EMBS*, Milano, Italy, session on “Information Dynamics in Networks of Biomedical Signals” – invited talk
- Aug 19, 2016: *38th Annual International Conference of the IEEE-EMBS*, Orlando, FL, USA, minisymposium on “Advances in Brain Connectivity Analysis: Perspectives and Pitfalls” – invited talk
- May 30, 2017: *IEEE Ukraine Conference on Electrical and Computer Engineering (UKRCON)*, Kyiv, Ukraine – **invited keynote lecture**
- Jul 13, 2017: *39th Annual International Conference of the IEEE-EMBS*, Jeju island, Korea, session on “Brain and Physiological Networks: Methods and Applications” – invited talk
- Jul 28, 2017: *1st International Summer Institute on Network Physiology*, Como, Italy – invited lecture

6 Reviewer Activity

Referee for the following journals (about 25 papers per year):

- Engineering

Advances in Adaptive Data Analysis; Annals of Biomedical Engineering; BioMedical Engineering OnLine; Biomedical Engineering (Biomedizinische Technik); Biomedical Signal processing and Control; Computers in Biology and Medicine; Cardiovascular Engineering and Technology; IEEE Transactions on Biomedical Engineering; IEEE Transactions on Cybernetics; IEEE Transactions on Signal Processing; IEEE Transactions on Neural Systems & Rehabilitation Engineering; Journal of Neural Engineering; Proceedings of the IEEE; Medical and Biological Engineering and Computing; Methods of Information in Medicine

- Neuroscience

BEhaviormetrika; Brain Connectivity; Brain Topography Cognitive Neurodynamics; Journal of Neuroscience Methods; Neuroimage

- Physics/Applied Mathematics

Physical Review Letters; Chaos, Solitons and Fractals; Entropy; EPJ Nonlinear Biomedical Physics; Fluctuation and Noise Letters; Physical Review E; Philosophical Transactions A; International Journal of Statistical Mechanics; IEEE Trans. on Cybernetics; Physiological Measurement; Statistics in Medicine

- Multidisciplinary Journals

Discrete Dynamics in Nature and Society; PLOS One; PLOS Computational Biology; Scientific Reports

- Physiology/Medicine

Autonomic Neuroscience: Basic and Clinical; European Journal of Applied Physiology; Journal of Physiology; Physiological Research; Microcirculation

Reviewer for special issue proposals: journal *Computational and Mathematical Methods in Medicine*, 8 proposals evaluated (2014-2016)

COLLABORATION PROJECTS

1 Active Collaborations

- 2001-present: Department of Technologies for Health, University of Milano, Italy (Alberto Porta)
- 2011-present: US Navy Experimental Diving Unit, Panama City, FL, USA (John P. Florian)
- 2012-present: Department of Neurology, Sacro Cuore Don Calabria Hospital, Negrar (VR), Italy (Gianluca Rossato)
- 2013-present: Department of Data Analysis Faculty of Psychological and Pedagogical Sciences, University of Gent, Belgium (Daniele Marinazzo)
- 2014-present: Biomed Group, Department of Electrical Engineering, KU Leuven, Belgium (Sabine Van Huffel)
- 2014-present: Department of Physiology, Comenius University, Jessenius Faculty of Medicine, Martin, Slovakia (Michal Javorka)
- 2014-present: Aragon Institute of Engineering Research, University of Zaragoza, Spain (Juan Pablo Martinez)
- 2014-present: Centro E. Piaggio, Bioengineering and Robotics Research Center, Pisa, Italy (Gaetano Valenza)
- 2014-present: Department of Physics, University of Bari, Italy (Sebastiano Stramaglia)
- 2015-present: Departamento de Engenharia Eletrônica, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil (Alessandro Beda)
- 2015-present: , Engineering and the Environment University of Southampton Highfield, Southampton, UK (David Simpson)
- 2016-present: Department of Physics, Boston University, MA, USA (Plamen Ch. Ivanov)
- 2017-present: Ludovico Minati (Institute of Innovative Research, Tokyo Institute of Technology, Tokyo, Japan)

2 Past Collaborations

- 1999-2007: Cardiology and Neurology divisions, S. Chiara Hospital of Trento, Italy (M. Disertori, Dr. D. Orrico)
- Department of Electrical and Information Technology, University of Lund, Sweden (L. Sörnmo)
- 2000-2005: Laboratorio per l'analisi e la modellizzazione della variabilità cardiorespiratoria, Fondazione S. Maugeri, Istituto Scientifico di Montescano, Italy (G.D. Pinna)
- 2000-2004: Department of Pre-clinical Science, University of Milano, Italy (M. Pagani, Prof. N. Montano)
- 2002-2005: ET Medical Devices, Cavareno-Milano, Italy (A. De Giuli)
- 2007-2012: Department of Biomedical Engineering, Worcester Polytechnic Institute, MA, USA (Ki H. Chon)
- 2013-2014: Radiation Sciences Group, University of Umea, Sweden (Urban Wiklund)
- 2013-2015: Department of Psychiatry, Erasmus Academic Hospital of Free University of Brussels, Belgium (Fabrice Jurysta)
- 2013-2016: [Department of Electrical and Computer Engineering, Faculty of Engineering, Aristotle University of Thessaloniki](#), Greece (Dimitris Kugiumtzis)
- 2015-2016: Institute of Theoretical Physics and Astrophysics, Gdansk University, Poland (Danuta Makowiec)

AMBITI DI RICERCA

- **Research Activity:** Development of advanced biomedical signal processing methods for the analysis of complex physiological systems, aimed at mechanism understanding and disease assessment
- **Methodological approach:** Measurement of physiological time series from biomedical signals; development of methods for multivariate time series analysis in the time domain (prediction methods), frequency domain (spectral analysis) and information domain (entropy-based measures) for the quantitative description of the complexity of individual systems, the coupling between systems and their causal interaction.
- **Applicative contexts:** neurophysiology; brain connectivity; cognitive neuroscience; cardiovascular neuroscience; cardiac, cardiorespiratory and cerebrovascular regulation; heart rate variability; cardiac atrial fibrillation; brain-heart interactions; network physiology.
- **Aims:** characterization of brain, cardiac and multi-organ physiological mechanisms in physiological states (e.g.: aging, sleep, cognition, resting states, physiological stressors) and diseased conditions (e.g.: sleep disorders, syncope, epilepsy, cardiac fibrillation)

ALTRE ATTIVITA

Software

I release Matlab code which implements the algorithms for biomedical data analysis and signal processing developed during my research activity (see www.lucafaes.net):

- 2011: eMVAR: Toolbox for extended multivariate autoregressive modeling – computation of classic and advanced frequency domain connectivity measures
- 2013: eMVAR: Toolbox for block-based MVAR connectivity analysis – computation of connectivity measures for multiple blocks of interacting time series
- 2014: cTE: Toolbox for Corrected Transfer Entropy analysis – computation of information transfer in multivariate time series
- 2015: eGC: Toolbox for extended Granger Causality analysis – computation of classic and advanced time domain measures of directional interaction among multiple signals
- 2016: ITS: Matlab Tool for the computation of Information Dynamics – implementation of several information-theoretic measures for the analysis of physiological time series
- 2017: ARres: Matlab Tool for Computing Confidence Limits of Measures derived from Autoregressive Modeling of Time Series
- 2017: LMSE: Matlab Tool for the computation of Linear Multiscale Entropy
- 2017: MSGC: Matlab Tool for the computation of multiscale Granger Causality
- 2017: MSID: Matlab Tool for multiscale Information Decomposition