

Francesco Chiavaioli

Birth date 05 February 1984
Birth Place Acquapendente (VT), Italy
Private Address 38B Aurelia Vecchia Street, Fonteblanda – Orbetello (GR),
58010, Italy
Telephone 0039 3338949864
Email francesco.chiavaioli@gmail.com
Marital Status Unmarried
Nationality Italian

<http://it.linkedin.com/pub/francesco-chiavaioli/1b/414/462>
http://www.researchgate.net/profile/Francesco_Chiavaioli/

Education

2008-2012

- Ph.D. in Information Engineering from the University of Siena. During the first year of Ph.D. he focused his efforts on the study and characterization of electrochemical sensors by means of impedance measurements at the Electronics, Electrical Engineering and Measurements laboratory. To do this, an in-house complete measurement system was developed, made up of a hardware part (front-end circuit) and a software one (virtual instrument in NI LabVIEW environment). The manufactured system makes it possible to accurately and precisely measure the impedance of both two and three electrode electrochemical sensor from 1 Hz to 5 MHz. From the second year of Ph.D. he moved to the "Nello Carrara" Institute of Applied Physics of the National Research Council of Italy (IFAC-CNR) and drew attention to optical fiber sensors based on gratings. At the beginning he focused his efforts on the study and manufacturing of optical fiber gratings (long period gratings, LPGs, and fiber Bragg gratings, FBGs) which make it possible to measure a series of physical parameters, such as temperature, strain, bending and refractive index of the medium surrounding the fiber cladding. The goal of this new activity was to develop an optical biosensor based on a thermo-stabilized flow cell for compensated refractometric measurements using a hybrid cascaded LPG and FBG configuration. The developed system provides satisfactory performances as far as the refractive index sensitivity, resolution and long-term stability are concerned. For all these reasons, the system is using for label-free chemical and biochemical sensing.

2009

- Examination of State Certification to practice as an Engineer (class of Information Engineering) from University of Florence. All major issues concerned the Telecommunications Engineering, especially telecommunication networks and project of telecommunication systems.

2006-2008

- Master Degree with maximum marks (110/110) cum laude in Telecommunications Engineering from the University of Siena. Thesis "Design and implementation of an instrument for impedance measurement of electrochemical sensors". During these studies he focused his efforts on the development of both physical and electrical model for two and three electrode electrochemical sensors. Finally he manufactured a front-end electronic circuit in order to characterized these sensors.

2003-2006

- Bachelor's Degree with maximum marks (110/110) in Telecommunications Engineering from the University of Siena. Thesis "Design and implementation of an instrument to measure vibrations produced in human body at work". During these studies he focused his efforts on the development of an in-house measurement system, made up of a hardware part (front-end circuit and a commercial accelerometer) and a software one (virtual instrument in NI LabVIEW environment). The manufactured system makes it possible to accurately and precisely measure the mechanical vibrations transmitted to the human body in compliance with the ISO 5349 and 8041 Standards.

Schools

2009

- International PhD School of GE ("Gruppo Elettronica") Group - Trento (TN) 2009, June 15 - June 17.

2010

- National PhD School of GE ("Gruppo Elettronica") Group - Villa Mondragone, Monte Porzio Catone (RM) 2010, June 7 - June 9.
- National PhD School of GMEE ("Gruppo Misure Elettriche ed Elettroniche"), Seminario d' Eccellenza "Italo Gorini" - Pistoia (PT) 2010, August 30 - September 3.
- National PhD School on Optical Biosensors and Biophotonics - Ischia (NA) 2010, September 25 - October 1.

2011

- National PhD School of GMEE ("Gruppo Misure Elettriche ed Elettroniche"), Seminario d' Eccellenza "Italo Gorini" - Siena (SI) 2011, September 5 - September 9.

Conferences

2011

- XVI Annual Conference AISEM ("Associazione Italiana Sensori e Microsistemi") 2011, C.R. ENEA Casaccia (RM), February 7-9 - "Cascaded LPG and FBG integrated in a miniaturized flow cell for refractometric measurement" (Oral Presentation + Book Chapter)

- SPIE Optics + Optoelectronics 2011, Prague Congress Centre Prague, Czech Republic, April 18-21 – “Cascaded optical fibre long period and Bragg gratings for strain and temperature cross-sensitivities compensation in refractive index measurements” (Book of Abstracts)

Job Experience

2008

- He was employed for two months by University of Siena, College of Engineering, as laboratory technician (Electrical Engineering, Electronics and Measurement laboratory) with the responsibility of design and implementation of electronic circuits, management of technically advanced electronic instrumentation and development and implementation of automatic measuring chains. In this role he had the opportunity to enhance the knowledge of the Orcad package, LabVIEW and Matlab environment together with the ability to design and implement electronic circuits and automatic chains for electrical measurements and manage technically advanced electronic instrumentation.

Teaching

During the Ph.D. he played a teaching aid in some university course disguised as seminars at the University of Siena. Furthermore he worked as a supply teacher (teacher of third range) of Systems, Automation and Organization of Production at “Leonardo da Vinci” Higher Education Institution from September to October 2010.

Seminar for Siena:

- (a.y. 2009/2010) Measurements for Automation (Arezzo)
- (a.y. 2009/2010) Electrical and Electronic Measurements
- (a.y. 2010/2011) Electrical and Electronic Measurements
- (a.y. 2009/2010) Optoelectronics
- (a.y. 2010/2011) Sensors and Microsystems
- (a.y. 2009/2010) Electronics for Telecommunications
- (a.y. 2010/2011) Electronics for Telecommunications

Research Interests

His main interests include:

- The study and development of a front-end electronic circuit for impedance measurements of two and three electrode electrochemical sensors
- The study and development of optical fiber sensors based on both long period gratings (LPGs) and fiber Bragg gratings (FBGs)

- Fabrication techniques for optical fiber gratings and acquisition and data processing systems
- Microfluidic systems for biochemical sensors
- New techniques for compensated refractive index measurements

His research activity starts in 2008 with the study of electrochemical sensors and the development of the first prototype of a front-end electronic circuit for two and three electrode electrochemical sensors. During the Ph.D. years his scientific interests pertained first to impedance measurements for electrochemical sensors and recently the study and characterization of optical fiber sensors based on gratings as well as of a thermo-stabilized flow cell for compensated refractive index measurements as promising tool for label-free chemical and biochemical sensing.

In details:

- Concerning the chemical sensing he was involved in the development of hardware and software for two and three electrode electrochemical sensors able to perform impedance measurements with good accuracy and very small error. Among such measurement of importance are the possibility to extract a precise impedance profile of both the modulus and phase by means of a frequency sweep in order to extrapolate the physical and chemical parameters of the under-test sensor.
- During the second part of PhD studies accomplished by "Nello Carrara" Institute of Applied Physics of the National Research Council of Italy he focused on the analysis, design and characterization of optical fiber sensors based on gratings: both long period gratings (LPGs) and fiber Bragg gratings (FBGs). In particular among such sensor it can be pointed out the LPGs are very sensitive to refractive index (RI) of the medium surrounding the fiber cladding, but they are also sensitive to other physical parameters, such as temperature and axial strain particularly. To perform accurate RI measurements for liquid samples, a thermo-stabilized flow cell for compensated RI measurements based on a hybrid cascaded LPG and FBG configuration was developed and characterized by means of a water-glycerol mixtures in different volumetric ratios. The experimental results show that the proposed system provides satisfactory performances as far as the refractive index sensitivity and resolution are concerned. The maximum sensor sensitivity and resolution are 3120 nm/RIU and 2×10^{-5} RIU, respectively. The long-term stability of the sensor was also tested with excellent results.

Recently his interests focused on the use of the above described refractive index sensing system in the field of label-free chemical and biochemical sensing. For this purpose different tests of the proposed biosensor have been developed and evaluated in order to understand both the kinetics of reactions and the amount of biological materials which is deposited on the functionalized fiber surface. All this allows us to achieve the metrological parameters of the biosensor, such as sensitivity and resolution (or limit of detection).

Selected Publications

- 1 2012 BALDINI F, BRENCI M, CHIAVAIOLI F, GIANNETTI A, TRONO C (2012). *OPTICAL FIBRE GRATINGS AS TOOLS FOR CHEMICAL AND BIOCHEMICAL SENSING*. Analytical and Bioanalytical Chemistry (Springer Berlin / Heidelberg), vol. 402 (1), ISSN: 1618-2642, doi: 10.1007/s00216-011-5492-3
- 2 In press CHIAVAIOLI F, MUGNAINI M, TRONO C, BALDINI F, BRENCI M (2012). *CASCADED LPG AND FBG INTEGRATED IN A MINIATURIZED FLOW CELL FOR COMPENSATED REFRACTOMETRIC MEASUREMENT*. In: (A. D'Amico et al. Eds.) *Lecture Notes in Electrical Engineering: Sensors and Microsystems: AISEM 2011 Proceedings*, vol. 109, NEW YORK: SPRINGER SCIENCE+BUSINESS MEDIA, LLC 2012, ISBN: 9781461409342, doi: 10.1007/978-1-4614-0935-9_41
- 3 2011 BALDINI F, BRENCI M, CHIAVAIOLI F, GIANNETTI A, TRONO C (2011). *OPTICAL FIBER REFRACTOMETER BASED ON A LONG PERIOD GRATING AND AN ACCURATE CROSS-SENSITIVITIES COMPENSATION SYSTEM INTEGRATED INTO A THERMO-STABILIZED FLOW CELL*. In: 4th EOS Topical Meeting on Optical Microsystems (OμS'11). Capri (NA) - Italy, September 26 - 28 2011, paper 4555
- 4 2011 CHIAVAIOLI F, MUGNAINI M, BALDINI F, BRENCI M, GIANNETTI A, TRONO C (2011). *RIFRATTOMETRO IN FIBRA OTTICA BASATO SU RETICOLO A PASSO LUNGO CON SISTEMA DI AUTOCOMPENSAZIONE DELLE CROSS SENSIBILITA'*. In: *Atti del XXVIII Congresso Nazionale del Gruppo Misure Elettriche ed Elettroniche*. Palazzo della Borsa - Sala delle Grida - Via XX Settembre 44 - Genova (GE), 12-14 Settembre 2011
- 5 2011 TRONO C, BALDINI F, BRENCI M, CHIAVAIOLI F, MUGNAINI M (2011). *FLOW CELL FOR STRAIN- AND TEMPERATURE-COMPENSATED REFRACTIVE INDEX MEASUREMENTS BY MEANS OF CASCADED OPTICAL FIBRE LONG PERIOD AND BRAGG GRATINGS*. *Measurement Science & Technology (IOP Publishing)*, vol. 22 (7); p. 075204, ISSN: 0957-0233, doi: 10.1088/0957-0233/22/7/075204
- 6 2011 TRONO C, BALDINI F, BRENCI M, CHIAVAIOLI F, FALCIAI R (2011). *FLOW CELL WITH HYBRID LPG AND FBG OPTICAL FIBER SENSOR FOR REFRACTOMETRIC MEASUREMENTS*. In: *Proceedings of 21st International Conference on Optical Fiber Sensors*. Ottawa - Canada, May 15 - 19 2011, vol. 7753, p. 775392, doi: 10.1117/12.885126
- 7 2011 TRONO C, BALDINI F, BRENCI M, CHIAVAIOLI F (2011). *LONG PERIOD GRATING-BASED OPTICAL FIBRE SENSOR WITH INTERNAL OPTICAL FEEDBACK FOR THE RELIABLE MEASUREMENT OF REFRACTIVE INDEX IN LIQUID SAMPLES*. In: *Atti del XIII Convegno Nazionale delle Tecnologie Fotoniche*. Palazzo Ducale - Genova (GE), 9 - 11 Maggio 2011
- 8 2011 TRONO C, BALDINI F, BRENCI M, CHIAVAIOLI F, FALCIAI R, GIANNETTI A, MUGNAINI M (2011). *LONG PERIOD AND FIBER BRAGG GRATINGS WRITTEN WITHIN THE SAME FIBER FOR SENSING PURPOSES*. In: *Proceedings of SPIE Photonics West 2011, Integrated Optics: Devices, Materials, and Technologies XV*. The Moscone Center -

San Francisco, California, USA, January 22 - 27 2011, vol. 7941, p. 794112, doi: 10.1117/12.873796

- 9 2010 CHIAVAIOLI F, MUGNAINI M, BALDINI F, BRENCI M, GIANNETTI A, TRONO C (2010). *SENSORE DI INDICE DI RIFRAZIONE IN FIBRA OTTICA BASATO SU RETICOLI A PASSO LUNGO*. In: Atti del XXVII Congresso Nazionale del Gruppo Misure Elettriche ed Elettroniche. Centro Congressi Hotel Summit - Gaeta (LT), 13 - 15 Settembre 2010
- 10 2009 FORT A, CHIAVAIOLI F, LOTTI C, MUGNAINI M, ROCCHI S, VIGNOLI V (2009). *A LABORATORY IMPEDANCE METER FOR ELECTROCHEMICAL SENSORS*. In: AIP Conference Proceedings, vol. 1137, p. 303-305, doi: 10.1063/1.3156532
- 11 2009 FORT A, CHIAVAIOLI F, LOTTI C, MUGNAINI M, ROCCHI S, VIGNOLI V (2009). *IMPEDENZIMETRO DA LABORATORIO PER LA CARATTERIZZAZIONE DI SENSORI ELETTROCHIMICI*. In: Atti del XXVI Congresso "GMEE" Gruppo Misure Elettriche ed Elettroniche. Salerno, 16 - 19 Settembre 2009

Il sottoscritto ai sensi delle norme in materia di dichiarazioni sostitutive di cui agli art. 46 e seguenti del D.P.R. 445/2000 dichiara che quanto contenuto nel presente curriculum vitae corrisponde a verità. Inoltre, il sottoscritto autorizza al trattamento dei dati personali, secondo quanto previsto dalla legge 196/2003 del 30 giugno 2003.