

Prof. Giovanna Sansoni
Short CV of Teaching and Research activity
2017



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1 Curriculum

I received my degree in Electronic Engineering at the Politecnico of Milan, Italy, in 1984. In 1985 I joined the Dept. of Industrial Automation (now Dept. of Electronics for the Automation) at the University of Brescia, Italy. I am now Full Professor of Electrical and Electronics Measurements and at the Department of Electronics for the Automation of the University of Brescia. Since 2001 I am the responsible of the research activity of the Lab. of Optoelectronics of the Dept. of Electronics at the University of Brescia.

My activities are briefly summarized below.

1.1 Research

ATT.1: DEVELOPMENT AND METROLOGICAL CALIBRATION OF ELECTRO-OPTICAL INSTRUMENTATION FOR APPLICATIONS TO NON-CONTACT, THREE-DIMENSIONAL MEASUREMENT

I have been working at the development and the metrological characterization of optical instrumentation for 3-D acquisition of surfaces since 1990. This activity has led to development, characterization and validation of the following measurement instruments:

1. Instrument based on a single bidimensional, non coherent light pattern, using phase coding;
2. Instrument based on the projection of a single light pattern, using two-frequency pattern and phase measurement;
3. Instrument based on multipattern projection PMP (Phase Shift Profilometry);
4. Portable instrument for the multiview acquisition of complex objects, using multipattern light projection and combined Gray-Code Phase Shift technique;
5. Instrument based on the photogrammetric and structured light approaches, for the three dimensional measurement of profiles.

ATT.2: REVERSE ENGINEERING AND RAPID PROTOTYPATION: APPLICATIONS TO MANUFACTURING, AUTOMOTIVE, CULTURAL HERITAGE AND BIOMEDICAL FIELDS

The experience gathered in the development of 3D instrumentation has motivated me to apply them in reverse engineering applications, to obtain topological and mathematical models of complex, free-form surfaces, for rapid prototyping (RP) and CAD-CAM applications. This activity represents a relevant benchmark for (i) the evaluation of the measurement performance of the acquisition systems, (ii) the demonstration of the usability of the optical sensor as the sole measurement source of the entire process, (iii) the completion of relevant measurement campaigns "in situ".

The work developed in this context has also led me to develop suitable alignment and editing software for multi-view registration, to be used when a limited number of views and low-cost applications are involved.

The most important results of this research activity are documented in the following fields:

1. cultural heritage domain
2. automotive domain
3. crime scene documentation
4. legal medicine
5. maxillo-facial prosthetics

ATT.3: DEVELOPMENT OF INSTRUMENTATION AND METHODS FOR INDUSTRIAL APPLICATIONS

This activity deals with development and characterization of electro-optical instrumentation for the industrial framework. The most important projects are listed below:

1. Development of systems and techniques for the measurement of waviness and roughness of machined surfaces.
2. Development of data acquisition systems for on-line control of shape and of temperature of trains.
3. Development and characterization of light-stripe sensors for contactless measurement of pipe eccentricity.

ATT.4: MECHANICS AND ROBOTICS

The research activities that I have developed in this context are listed below:

1. Development of vision for robotics. This activity has recently started on request of an industrial commissioner (DENSO EUROPE B.V.). The aim is to develop suitable algorithms of vision for pick & place applications. Both 2D and 3D systems are under development in view of their integration on the robot arm.
2. Combined use of optical and contact probes in CMMs. This activity was aimed at integrating the measurement information from a 3D Vision sensor and a Coordinate Measuring Machine (CMM) for the reverse engineering of free-form surfaces. The objective was to reconstruct the CAD model of complex shapes with high accuracy and at the same time rapidly, and minimising the operator time.

ATT.5: 2D VISION FOR MEDICINE AND INSPECTION

The research activities that I have developed in this context are listed below:

1. Acquisition and elaboration of fluorescence images of biomedical interest aimed at the development of flexible and adaptive measurement

procedures that allow the execution of real-time elaboration of the images.

2. Development of systems for the elaboration of OCT images
3. Development of calibration methods for active and passive video-cameras.
4. Development of peak-detection, edge detection, blob analysis algorithms.
5. Development and application of methods of non-linear unsharp masking.
6. Development of systems for quality control in industrial applications.

1.2 Education

Since 1990 I have been teaching the students of the Engineering Faculty of Brescia. Here the courses are listed:

Instrumentation and Measurement

Electronic Instrumentation

Elaboration of signal and of measurement information

Electronic Computers

Optical Measurements

Vision systems for industry

2D vision systems

3D Vision systems

2 List of Publications

2.1 International journals

[1] S. Pasinetti, I. Bodini, M. Lancini, F. Docchio, G. Sansoni, "A depth from defocus measurement system using a liquid lens objective for extended depth range", IEEE Transactions on Instrumentation and Measurement, (**2017**) in press.

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- [11] G. Sansoni, F. Docchio, "From optical acquisition to rapid prototyping: applications to medicine and to cultural heritage", in: *Rapid Prototyping/ Book 2*, ISBN 979-953-307-048-2, 2011, pp. 153-178.
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- [13] G. Sansoni, C. Cattaneo, M. Trebeschi, D. Gibelli, P. Poppa, D. Porta, M. Maldarella, M. Picozzi, "Scene of crime analysis by a 3D optical digitizer: a useful perspective for forensic science", *Am J Forensic Med Pathol*, 32(3), (2011) pp. 280-286.
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