

# Alberto BEINAT

**Dipartimento Politecnico di Ingegneria e Architettura – Università degli Studi di Udine**

ORCID ID: <http://orcid.org/0000-0003-2015-6013>

Scopus Author ID: 6505954017

Web of Science Researcher ID: AAQ-9525-2021

## **EDUCATION AND TRAINING**

---

**Scientific high school diploma** obtained in 1979 at the Liceo Scientifico “G. Marinelli” in Udine;

**Degree** in Civil Engineering for Soil Protection and Territorial Planning issued in 1986 by the University of Udine;

**Qualification** to practice as an engineer obtained in 1987 and enrollment in the Register of Engineers of the Province of Udine (n. 1434/A);

**PhD** in Geodetic and Topographic Sciences (XIII cycle) obtained in 2000 at the Politecnico di Milano.

## **PROFESSIONAL CAREER**

---

**Freelance engineer** and collaborator at Rizzani de Eccher, Compagnia Europea Appalti, Studio ing. Filippuzzi of Udine, from 07/1986 to 02/1988. Activities: structural calculation, civil-industrial design coordination, supervision of construction site activities (Sumy, Ukraine).

**Graduated Technician** (ex Law 1255/61), then **Technical Officer** (VIII q.f.) at the Institute of Earth Sciences and at the Department of Earth Resources and Territory of the University of Udine, from 03/1988 to 01/2004. Activities: scientific and technological research in the field of geophysics and topographic and satellite surveying disciplines, system manager and lan manager of the departmental computer network.

**University researcher** Area 08/A4 "Geomatics" Sector ICAR/06 "Topography and Cartography" at DIGE, DICA and DPIA of the University of Udine, from 01/2004 to 09/2021. Activities: scientific and technological research in the fields of geomatic engineering, university and non-university teaching on the topics of surveying technologies and GIS.

**Associate Professor** Area 08/A4 "Geomatics" Sector ICAR/06 "Topography and Cartography" at DPIA of the University of Udine, from 10/2021 to today. Activities: scientific and technological research in the fields of geomatic engineering (topography, GNSS, remote sensing, cartography, GIS), university and non-university teaching on the subjects of geomatic disciplines.

## **INSTITUTIONAL ACTIVITY**

---

**Founding partner** in 2008 of the university spin-off "e-laser" (<http://www.e-laser.it>), dedicated to technical services for the detection, coordination, analysis and processing of scientific and/or statistical data in the environmental, agricultural, forestry and territorial sectors, including topographic, aerial photogrammetric and remote sensing services.

Elected member since 2000 in the **steering board** of CARTESIO - Interdepartmental Center for Cartography and Territorial Information Systems of the University of Udine.

**Director** of the CARTESIO Interdepartmental Center for the period 2016-2019.

**Coordinator** from 04/2023 of the Unified Council of Professionally Oriented Study Courses in Building and Territory Techniques (L-23 - L-P01) for the academic year 2022/23 and the academic three-year period 2023/26.

**Member** since 2021 of the "Commission for Quality Assurance", of the "Didactic Commission", and of the "Internship Commission" of the L-23 and L-P01 Degree Courses in Building and Territory Techniques.

**Member** since 2013 of the "Commission for Quality Assurance" of the Master's Degree Course in Environmental and Land Engineering, now Master's Degree Course in Environmental, Land and Civil Protection Engineering.

**Member** since 2012 of the "Didactic Commission" of the Master's Degree Course in Environmental and Territorial Engineering.

## **RESEARCH DOCTORAL ACTIVITIES**

---

**Component** since 2010 of the **research doctorate board** in "Economics, Ecology and Protection of Agricultural and Landscape-Environmental Systems" (XXVI and XXVII cycle), then since 2012 (XXVIII, XXIX and XXX cycle) of the **research doctorate board** in " Economy, Ecology, Landscape and Territory".

**Component** since 2016 of the inter-university **research doctorate board** of the University of Trieste (administrative office) and of the University of Udine (affiliated office) in "Civil-environmental engineering and architecture" for cycles XXXII, XXXIII, XXXIV, XXXV , XXXVI, XXXVII and XXXVIII.

## **TEACHING ACTIVITY**

---

AY 2004/05, 2005/06, 2006/07, 2007/08, 2008/09: Teaching "**Topography**" at the Degree Course in Architecture Sciences of the Faculty of Engineering of the University of Udine;

AY 2007/08, 2008/09: Teaching "**Ecology**" (6 credits); aa.aa. 2009/10, 2010/11 teaching "**Applied Ecology**" (6 CFU) at the Degree Courses in Environmental and Resources Engineering and Civil Engineering of the Engineering Faculty of the University of Udine;

AY 2011/12 academic year: Teaching "**Topographic Surveys for Environmental Control I**" (6 CFU) and "**Topographic Surveys for Environmental Control II**" (6 CFU) at the Master's Degree Course in Environmental and Territorial Engineering of the University of Udine;

AY 2012/13, 2013/14, 2015/16, 2016/17, 2017/18, 2018/19, 2019/20, 2020/21, 2021/22: Teaching of "**Topographic Surveys for Environmental Control**" (6 credits) in the master's degree courses in Civil Engineering and Environmental and Territorial Engineering of the University of Udine;

AY 2012/13, 2013/14, 2015/16, 2016/17, 2017/18, 2018/19, 2019/20, 2020/2021. 2012/22: Teaching of "**Environmental Geomatics**" (6 ECTS) at the Master's Degree Courses in Civil Engineering and Environmental and Territorial Engineering of the University of Udine;

AY 2021/22 Teaching of "**General Topography**" (6 ECTS) at the Degree Courses in Building and Territorial Techniques of the University of Udine;

AY 2022/23 Teaching of "**Topographic techniques for the control of the territory and of constructions**" (6 CFU) at the master's degree courses in Civil Engineering and Environmental and Territorial Engineering of the University of Udine;

AY 2022/23 Teaching of "**Digital Terrain Models and Remote Sensing**" (6 ECTS) at the Master's Degree Courses in Civil Engineering and Environmental and Territorial Engineering of the University of Udine;

AY 2022/23 Teaching of "**Principles of Topography and Cartography**" (6 ECTS) at the Professionalizing Degree Courses in Building and Territorial Techniques of the University of Udine;

AY 2006/07, 2007/08, 2008/09: Teaching of "**Numerical cartography, cadastral and reference systems**" at the 1st level University Master's Degree in Territorial Information Systems. Member of the Master Board;

AY 2009/10, 2011/12 Teaching "**Numerical Cartography**" and "**Integrated Topographic Survey**" at the II level University Master in Hydrogeological Risk Analysis, Evaluation and Mitigation (AVAMIRI);

AY 2010/11, 2011/12: Seminars on **cartography, GNSS and GIS** within the PhD in Economics, Ecology and Protection of Agricultural and Landscape-Environmental Systems.

from AY 2003/04 to present: Seminars on **GNSS systems** for the teachings of "Methods of surveying and representation of the territory" and "Geomatics" at the Degree courses in Agricultural Sciences and in Environmental and Nature Sciences of the University of Udine;

AY 2010/11 Seminars and supplementary teaching within the course "Special surveys for the environment and the territory I and II" at the Master's Degree Courses in Environmental and Territory Engineering of the University of Udine;

from AY 2003/04 to present: Complementary teaching for the course "**Topography**" at the Degree Course in Civil - Environmental Engineering of the University of Udine;

AY 2018/19: Complementary teaching for the teaching "**General Topography**" in the Degree Course in Building and Territorial Techniques;

from AY 2003/04 to present: Member of the Degree and Master's Degree Commissions of Civil Engineering, Engineering for the Environment, Territory and Civil Protection and for the Professional Degree in Building and Territory Techniques;

AY 2012/2013: Teaching, assessment and tutoring within the TFA – Active Training Internship – Qualification class A072 of the University of Udine;

AY 2012/2013: Collaboration with the Friuli Training Consortium (of which the University of Udine is a part) in the design of the "IFTS Course - Higher Technical Education and Training "Higher Technician for computerized territorial surveys" FP1144479001 and execution of the modules "**Territorial and topographical data** " and "**Techniques for the production of territorial data**";

from AY 2003/2004 to date: Supervisor/co-supervisor of several dozen Master's Theses, Degree Theses in Civil-Environmental Engineering, and Master's Degree Theses in Civil Engineering and in Environmental and Territorial Engineering;

in 2018: Teaching at the Summer school "**ISD - Introduction to Spatial Database**" of the University of Udine at the CISM - International Center of Mechanical Sciences.

## **SCIENTIFIC ACTIVITY**

---

At the beginning of his career, the research activities are located in the field of Applied Geophysics, with the design and implementation of the seismic signal processing system, on an Intel 8086 DOS platform, serving the first remote monitoring station installed on the Stromboli volcano, entirely

designed and built by the Seismology working group of the University of Udine (Ref. Prof. M. Riuscetti).

Subsequently, the interest turns to the themes of Geodesy and takes the form of participation in important geodetic campaigns in the context of national and international research projects. Among these activities, the most significant are the redetermination of the elevations of Mount Everest (1992) and K2 (1996) within the Ev-K2-CNR project promoted by Prof. A. Desio. These are flanked by topographic and satellite monitoring campaigns for the control of neotectonics conducted in the Himalayas (Ev-K2-CNR, 1991), the Mediterranean (Tyrgonet, 1990, 1991), the Alps (Alpenraverse, CERGOP, 1993, 1994), the Strait of Messina (1989), Friuli (1988, 1989, 1990, 1991, 1993, 1994, 1997, 1998), Toscana (1991, 1995) and other similar activities, including the survey of the archaeological site of Tell-Mishrife in Syria (1999). These experiences have made it possible to acquire significant skills in the field of operational geodesy, from the design of networks to the acquisition and processing of topographic and satellite measurements.

With the doctorate (2000) the research activity was oriented towards analytical issues of data processing, linked to the diffusion of new survey technologies, such as laser scanning and GNSS, and to new cartographic products, such as cadastral numerical cartography and digital images. A common thread among these activities concerns the research and development of efficient solutions for issues related to datum transformations within any n-dimensional orthogonal space, both geometric and radiometric, for a varied class of problems, from photogrammetry, to the registration of lidar pointclouds, to the update of the cadastral numerical cartography, to the virtual geometric assembly of construction elements, up to the radiometric alignment of images.

Appreciable scientific results, including two patents and a spin-off, have been achieved by the doctorate and by the results of the Interreg IIIA Italy-Slovenia 2000-2006 Project "Recomposition of the cadastral cartography and integration of numerical regional cartography for the territorial information systems of local authorities by experimenting with new surveying techniques" as technical-scientific coordinator (Resp. Prof. F. Crosilla).

Exploration of emerging issues in Geomatics Engineering has expanded over time to other areas of the field. Currently the study activity concerns the pre-treatment of multispectral and hyperspectral aerial and satellite images, in the Remote Sensing sector, and the application of the SfM photogrammetric technique from UAVs (drones) for the creation of high resolution digital models for monitoring of constructions and territory, and their evolution over time.

The research activity is proven by over 110 editorial products, recorded on the IRIS, Scopus and WoS platforms and listed in a specific section.

## **RESEARCH PROGRAMS**

---

From 2003 to 2008: **Technical-scientific coordinator** of the Interreg IIIA Phare CBC Italy-Slovenia 2000-2006 project "Recomposition of the cadastral maps and integration of digital regional cartography for the territorial information systems of local authorities by experimenting with new survey techniques" among the University of Udine (scientific director Prof. Fabio Crosilla) and the Geodetski inštitut Slovenije (GI) of Ljubljana. The research activity has deepened the themes of the recomposition of cadastral cartography, laser scanning survey from aircraft, 3D City modeling and GIS and has resulted in the drafting of over 45 scientific papers, of which the best 15 are collected in the volume homonymous to the project, edited by F. Crosilla and A. Beinat (ISBN 887445048-6). The skills acquired and the results obtained from the Interreg project have created the premises for the establishment of a university spin-off active in the field of Lidar and remote sensing (e-Laser srl of Udine).

**Participant** in the PRIN program "National network for monitoring, modeling and sustainable management of erosion processes in agricultural, hilly and mountainous territories" (Scientific coordinator Prof. M. A. Lenzi, Scientific director Prof. F. Cazorzi) from 02/2013 to 01/2016

**Collaboration** with the working group of the Interreg Italy-Austria 2014-2020 project entitled "INnovative alarm system for DEtritrus flow events based on short-term forecasts and phenomenology" (INADEF) of the Department of Agri-Food, Environmental and Animal Sciences - DI4A of the University of Udine.

**Participant** in the PNRR project "Interconnected North-East Innovation Ecosystem (iNEST)" Spoke n. 1 – Ecosystems for Mountain Innovations Research Topic " Safety and quality of life in mountain environments" from 09/2022 to today

## **COLLABORATIONS WITH SCIENTIFIC JOURNALS**

---

Reviewer for the following ISI-WOS journals:

ISPRS Journal of Photogrammetry and Remote Sensing (Elsevier Publisher),

Automation in Construction (Elsevier Publisher),

Computers & Geosciences (Elsevier Publisher)

Applied Geomatics (Springer Publisher),

Earth Science Informatics (Springer Publisher),

Photogrammetry and Remote Sensing (ASPRS Publisher - American Society of Photogrammetry and Remote Sensing).

Remote sensing (MDPI Publisher - Multidisciplinary Digital Publishing Institute)

## **SCIENTIFIC RESPONSIBILITIES**

---

From 2004 to 2007: **Scientific manager** of the "2004-2006 Convention between Insiel S.p.A. [Friuli Venezia Giulia Region] and CARTESIO [University of Udine] " and "Extension of the same Convention" stipulated under the framework of the initiative DOCUP Objective 2 2000-2006 - Action 4.2.1 "Development of the communication and information system" - Project "Completion of the Mountain Real Estate Cadastre". This is a research agreement aimed at investigating certain issues relating to the recomposition of the cadastral cartography and at defining appropriate operating methodologies for its updating, as part of the implementation project to complete the Mountain Real Estate Cadastre (CIM). The activity was propaedeutic to the cadastral cartographic recomposition carried out by the Regional Administration on the whole territory of Friuli Venezia Giulia, including both the national system and the land register system.

From 2006 to 2007: **Scientific manager** of the contract between the University of Udine - CARTESIO and Autostrade per l'Italia Spa for the "Analysis of the quality of vector cartography and DTM produced by laserscanner and digital photogrammetry integrated surveys on some sections of the road network of Autostrade per l'Italia Spa". The investigations concerned the quality check of Lidar products, cartography, IR images and orthophotos on a total of 1,377.528 km of network. The relevant aspect concerned the research, development and experimentation of

methodologies for the analysis of Lidar products which had not yet been codified in the topographical practice of the time.

From 2017 to 2020, **scientific manager** of the contract between Insiel Spa [Friuli Venezia Giulia Region] and CARTESIO Interdepartmental Center [University of Udine] for "Conformity verification activities of the creation of the new regional digital cartographic system for the territory of the province of Trieste" . The contract requires the execution of metric and qualitative tests on the new cartographic products commissioned by the Friuli Venezia Giulia Region, consisting of precision orthophotos, lidar and hyperspectral surveys and topographic dB of the entire territory of the province and of the city of Trieste.

**Promoter** in 2018 of the establishment of a Temporary Association of Companies between the University of Udine (lead group agent), the University of Trieste (agent) and e-Laser srl (agent) for the "Conformity Verification of the Implementation of the New Cartographic System Digital Regional (reference GE 14-17)";

From 2018 to 2021, **scientific manager** of the contract between Insiel Spa [Regione Friuli Venezia Giulia] and the Temporary Association of Companies between the University of Udine (group leader agent), University of Trieste (agent) and e-Laser srl (agent) for the "Conformity Verification of the Implementation of the New Regional Digital Cartographic System (reference GE 14-17)". The contract requires the execution of metric and qualitative tests on the new cartographic products commissioned by the Friuli Venezia Giulia Region, consisting of true orthophotos, lidar and hyperspectral surveys of the entire territory of the provinces and cities of Gorizia, Pordenone and Udine and in the MMS survey of the viability of the main urban centres.

From 2020 to 2022, **scientific manager** of the contract between Insiel Spa [Friuli Venezia Giulia Region] and the Polytechnic Department of Engineering and Architecture [University of Udine] for the testing of the Topographic Database of the cities of Gorizia, Pordenone and Udine and of the numerical map derived from classification of orthoimages from high resolution aircraft using artificial intelligence techniques.

## **PATENTS AND SPIN-OFF**

---

2001: **Industrial patent** of the University of Udine n.ITUD2000A000160 "Method for making aerial triangulation". Inventors Alberto Beinat and Fabio Crosilla. [<https://www.uniud.it/it/rca/research/risultati-della-ricerca/brevetti/ilportafoglio-brevetti-delluniversita-di-udine>]

2004: **Industrial patent** of the University of Udine n. G01D21/02 "Procedure for automatically identifying correspondences between punctual geometric entities with no topological structure" - Inventors: Alberto Beinat, Fabio Crosilla and Emiliano Sossai [<https://www.uniud.it/it/ricerca/risultati-della-ricerca/patents/the-patents-portfolio-of-the-university-of-udine>]

2008 to present: **Founding member of the university spin-off** e-Laser srl, currently active and formerly located in the Luigi Danieli Science and Technology Park in Udine. The Company supplies products and services to organizations, public administrations, private companies and professionals operating in the field of land monitoring and management. Among the most qualifying activities, there is the creation and implementation of advanced software tools, based on original analysis methodologies, which allow for the production of innovation in the sectors of

remote sensing and 2D and 3D territorial information systems. The project and the company team were formed at the University of Udine, within the Interreg IIIA Italy-Slovenia 2000-2006 project entitled "Recomposition of cadastral cartography and integration of numerical regional cartography for territorial information systems of local authorities by experimenting new survey techniques". The founding group obtained the 1st Prize in the local final of the "National Innovation Award" held in Udine in October 2007. [<http://www.e-laser.it/ita/company/>].

## **CONFERENCE REPORTS**

---

- 2000: Speaker of the research "Examples of Georeferenced Data Transformations in GIS and Digital Photogrammetry by Procrustes Analysis Techniques" at the ISPRS Conference "Bridging the gap", Ljubljana, Slovenia 2-5/2/2000
- 2001: Speaker of the research "Fast And Optimal Assembling of Partial 3-D Object Models by Procrustes Analysis Techniques" at "The Italy-Canada 2001 Workshop on 3D Digital Imaging and Modelling. Applications of: Heritage, Industry, Medicine & Land", Padua , Italy. 3-4 April 2001.
- 2001: Speaker of the research "Generalised Procrustes Analysis for Size and Shape 3-D Object Reconstruction" at the 5th Conference on Optical 3-D Measurement Techniques. Wien, 1-4 October 2001
- 2001: Speaker of the research "A direct method for the simultaneous and optimal multidimensional models registration" at the "Urban 2001 IEEE/ISPRS Workshop". Rome, 8-9 November 2001
- 2002: Speaker of the research "The Procrustian methods for Aerial Triangulation" at the conference "Photogrammetry in the inertial age". Pavia, 13-14 June 2002
- 2003: Speaker of the research "Procrustes Statistics to Test for Significant OLS Similarity Transformation Parameters" at the V "Hotine-Marussi Symposium on Mathematical Geodesy" of the Int. Ass. of Geodesy, Matera, Italy 17-21/6/2003
- 2004: Speaker of the research "An automatic analytical procedure for searching corresponding feature points in a cadastral map" at FIG Working Week 2004 Athens, Greece, May 22-27, 2004.
- 2005: Speaker of the presentation "High resolution DTM by LiDAR technology" at the "Interreg IIIB "CATCHRISK" Final Meeting". FVG Autonomous Region. Udine 28 – 29 June 2005.
- 2005: Speaker of the research "An Innovative Approach to Harmonization of Cadastral Maps and Topographical Bases into Geographical Information Systems of local Agencies" at the "ISA-MAP Workshop". Trieste, 27 October 2005
- 2007: Speaker of the research "Global Registration of Non Static 3D Lidar Point Clouds: SVD Factorization and Robust GPA Methods" at "The 5th Int. Symposium on Mobile Mapping Technology" (MMT'07), Padova 29-31/05/2007
- 2007: Speaker of the research "A program for processing lidar data in a Linux environment" at the SIFET National Conference "Integration between innovative techniques for land surveying and cultural heritage", Palermo Mondello, 29/06-01/07
- 2007: Speaker of the research "Harmonization of the Land Cadastre Map of Gorizia: a Contribution for a Common Slo-I Transborder Map" at the INTERREG IIIA "HarmoGeo" Project Final Meeting, Nova Gorica, 13 November 2007
- 2009: Speaker of the presentation "Reference systems for GPS NRTK" at the conference "GPS-RTK: a real-time positioning service in Friuli-Venezia Giulia". Autonomous Region of Friuli Venezia Giulia and National Institute of Oceanography and Experimental Geophysics. Udine, 7 October 2009.
- 2010: Speaker of the research "The updating and recomposition of the cadastral map for the GIS of the Region and Local Authorities of Friuli Venezia Giulia: methodology and results" at the SIFET National Conference "The Land Registry in 2010: from Topography to Geomatics". Cagliari, 16-17-18 June 2010
- 2011: Speaker of the research "NRTK positioning services: performance analysis at the margins of the networks of permanent stations operating in Veneto and Friuli Venezia Giulia" at the SIFET national conference "Interdisciplinary Applications of Geomatics: Research, Training and Profession", Portonovo (Ancona) , 6/22-24/2011
- 2011: Speaker of the research "NRTK positioning at the edge of a network of permanent stations: experimental checks on the services available between Veneto and Friuli Venezia Giulia" at the Conference "GPS-RTK: a real-time positioning service in Friuli-Venezia Giulia" . Autonomous Region of Friuli Venezia Giulia and National Institute of Oceanography and Experimental Geophysics. Venzone, 18 October 2011.
- 2012: Speaker of the research "Cadastral Map Upgrading and Layers Harmonization for the Spatial Data Infrastructure in Friuli Venezia Giulia, Italy" at FIG Working Week 2012, Rome, Italy 6–10 May 2012

2015: Speaker of the research "Cadastral and land registry upgrading activities in Friuli Venezia Giulia, Italy/Dejavnosti na področju razvoja zemljiškega katastra in zemljiške knjige v Furlaniji, Julijski krajini, Italija" at the 43rd Geodetski Dan in Sezana (Slovenia) from 10-04 -2015 to 10-04-2015

2016: Speaker of the research "Shadow detection and removal in VHR RGB aerial images" at the conference "New Advanced Gns and 3D Spatial Techniques - Applications to Civil and Environmental Engineering, Geophysics, Archeology and Cultural Heritage in memory of Professor Giorgio Manzoni". Trieste 18, 19, 20 February 2016

2021: Speaker of the research: "The new geospatial data of the Friuli Venezia Giulia Region (Italy): a geomatic challenge" at the 30th International Cartographic Conference of the International Cartographic Association. Florence, 14-18 December 2021.

## **OTHER ACTIVITIES'**

---

**University tutor** for students engaged in internships at institutions, companies and professional studios;

**Member** of the PEI "Forestry Management" working group for the presentation of Projects in the context of the INTERREG Italy-Slovenia European Program ("Latifolia" Project) and the Rural Development Program (PSR), measure 16.1.1. - Autonomous Region of Friuli Venezia Giulia ("Pre-alpine wood" Project);

**Member** of international working groups for the presentation of research projects on competitive tenders. Projects: NOPAWA (Alpine Space 2008); PARCEMON (coordinating member) (South-East Europe 2008); SATELPLAN (South-East Europe 2010); EM-Lidar (Interreg ITA-SLO 2016); GEOMOSE (Interreg ITA-SLO 2009) and other minors;

**Consulting** and **training** activities for public administration technicians in the field of cartography, topographic survey and satellite positioning systems;

**Member** from 1998 to 2002 of the VFG Scientific Committee of the Italian Alpine Club;

Technical and scientific support to professionals and companies for the implementation of technical solutions for civil engineering based on the use of GNSS.