

## FORMATO EUROPEO PER IL CURRICULUM VITAE

### PERSONAL INFORMATION



### Marilena Cardu

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### WORK EXPERIENCE

01-10-2005 - Present	Associate Professor at Politecnico di Torino University (Environment, Land and Infrastructure Engineering Department - DIATI), in charge of the Excavation Engineering course. National Scientific Qualification as Full Professor (achieved in 2018).
November 2019 – Present	Responsible for the “Geomechanics and Geotechnologies” Laboratory at the DIATI, Politecnico di Torino
May 2015-September 2015	Visiting Researcher at ITU - Istanbul Technical University, working on “mechanical excavation/rock-tools interaction.”
October 2014-April 2015	Special Visiting Researcher–PVE at NAP. Mineração and LAPOL-USP, Escola Politecnica da Universidade de Sao Paulo, Brazil, working on the research project: “Integração da Geologia de Mina e do Desmonte de Rocha no Processo de Cominuição na Pequena Mineração” (Integrated Blasting in the comminution process of a small-scale mine: Research activities in the experimental mine of the USP Centre for Responsible Mining)
01-01-1996 – November 2019	Researcher assigned to the Environmental Geology and Geo-Engineering Institute of the National Research Council, formerly Studies’ Centre for Physics of Rocks and Geo-Technologies.
1992-2005	Assistant Professor at DIGET, Politecnico di Torino
1988-1992	Researcher at Italian National Research’s Council (SSD: Excavation Technologies, Explosives Engineering and Underground Works).
2003-present	Member of the Doctorate School’s College (Civil-Environmental Engineering) at Politecnico di Torino, formerly Environmental Geo-Engineering.

### EDUCATION AND TRAINING

2003 – 2004	“Master on Explosive Materials” at Genova University - Faculty of Mathematical, Physical and Natural Sciences – (thesis on Forecasting damages criteria to underground works by D&B techniques).
1989	PhD in Underground Resources Engineering (experimental thesis on Cyclic fatigue of rocks).
1985	Professional qualification as an Engineer
1984	MSc in Mining Engineering, Politecnico di Torino University (experimental thesis on Fluor-Gypsum characteristics, to be employed in an underground mine as backfilling).

### PERSONAL SKILLS

Mother tongue(s)	Italian																																		
Other language(s)	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">UNDERSTANDING</th> <th colspan="2">SPEAKING</th> <th rowspan="2">WRITING</th> </tr> <tr> <th>Listening</th> <th>Reading</th> <th>Spoken interaction</th> <th>Spoken production</th> </tr> </thead> <tbody> <tr> <td>English</td> <td>C1</td> <td>C1</td> <td>C1</td> <td>C1</td> <td>C1</td> </tr> <tr> <td>French</td> <td>C1</td> <td>C1</td> <td>C1</td> <td>C1</td> <td>C1</td> </tr> <tr> <td>Portuguese</td> <td>C1</td> <td>C1</td> <td>B2</td> <td>B2</td> <td>C1</td> </tr> <tr> <td>Spanish</td> <td>B1</td> <td>B2</td> <td>B1</td> <td>B1</td> <td>B2</td> </tr> </tbody> </table>		UNDERSTANDING		SPEAKING		WRITING	Listening	Reading	Spoken interaction	Spoken production	English	C1	C1	C1	C1	C1	French	C1	C1	C1	C1	C1	Portuguese	C1	C1	B2	B2	C1	Spanish	B1	B2	B1	B1	B2
	UNDERSTANDING		SPEAKING		WRITING																														
	Listening	Reading	Spoken interaction	Spoken production																															
English	C1	C1	C1	C1	C1																														
French	C1	C1	C1	C1	C1																														
Portuguese	C1	C1	B2	B2	C1																														
Spanish	B1	B2	B1	B1	B2																														

Levels: A1/A2: Basic user - B1/B2: Independent user - C1/C2 Proficient user  
[Common European Framework of Reference for Languages](#)

Communication skills good communication skills gained through the experience

Scientific responsibility for competitive National and International research projects, awarded through a peer-review process

- 2023: HORIZON EUROPE – 101091885 – MINE.IO - A Holistic Digital Mine 4.0 Ecosystem Project. Role: partner.
- 2021-2023: Collaboration with the REMIND project and research development at ESPOCH, Riobamba (Ecuador).
- 2021-2023: Research agreement between TELT SAS and the Politecnico di Torino (Departments involved: DISEG, DIATI and DISAT). Collaboration within the project: Research for innovative tools for supporting the logistics aimed at using excavated materials (muck) produced by the Turin-Lyon railway line for the best sustainability and circular economy of the process.
- 2019-2023: Collaboration agreement between the “Regione Piemonte” and the Politecnico di Torino for the implementation of the Regional Plan for Mining Activities (PRAE). Role: draw up the guidelines for the exploitation of quarries and mines in Piedmont.
- 2019-2022: DUO India Project on “Tunnel boring machine (TBM) performance prediction”, in cooperation with the Indian Institute of Technology (Indian School of Mines) Dhanbad University, Jarkand (India)
- 2018-2019: ENERBLAST (Energy in Blasting and Comminution) Project, in cooperation with Adolfo Ibanez University, Santiago (Chile)
- 2008-2010: Responsible, for the Italian part, of the Indo-Italian Executive Programme of S&T Co-operation on: Rock characterization and simulation for dimension stone cutting by diamond wire saw with special reference to marble (DITAG Politecnico di Torino - Department of Mining Engineering Indian School of Mines, Dhanbad)
- 2008-2011: Coordinator of the Working Group WP3 (The influence of techniques of excavation on the recycling of muck) in the Project “Innovative methods for the eco-compatible and sustainable recycling of muck from tunnel excavation, also considering the potential content of noxious minerals”, supported by the Piedmont Region
- 2001-2003: Partner of the International Project OSNET – Ornamental Stones Network –WG on: “State of the art in dimension stones quarrying”, Competitive and Sustainable Growth Programme, Contract N. G1RT-CT-2001-05019 (2001-2003).

National and international reputation and professional activity for the scientific community Memberships

- Member of Editorial Board of “Minerals”, (ISSN 2075-163X; CODEN: MBSIBI) an international peer-reviewed open access journal of natural mineral systems, mineral resources, mining, and mineral processing; Minerals is published monthly online by MDPI (form 2020).
- Member of Editorial Board of International Journal of Mining and Mineral Engineering, Interscience Publishers (ISSN: 1754-890X -Print, ISSN: 1754-8918 -Online), from 2010
- Member of Editorial Board of Mining Science Journal (already Prace Naukowe Instytutu Gornictwa Politechniki Wroclawskiej), included in “the Emerging Sources Citation Index (ESCI) by Thomson Reuters Web of Science™ Core Collection”, from 2015
- Associate Editor REM: Revista Escola de Minas (Printed version ISSN 0370-4467; On-line version ISSN 1807-0353), from 2015.
- “Project Evaluation Process”, in the context of “EIT Raw Materials”, of European Projects on the subject of “Education” (KIC added value activity), 2017.
- Member, appointed by the Politecnico di Torino, of European Innovation Partnership on Raw Materials (EIP) – High Level Steering Group (HLSG), 2018-present.
- Associate Editor REM: Revista Escola de Minas (Printed version ISSN 0370-4467; On-line version ISSN 1807-0353), from 2015.
- Reviewer for several leading international journals.
- Member of EU-Excert “Certifying Expertise in European Explosives Sector”, from 01-01-2004 to 31-12-2005.
- Member of International Society of Explosives Engineers (ISEE), from 01-01-1998 to 31-12-2013
- Member of International Organizing Committee “Mine Planning and Equipment Selection (MPES), since 2004.
- Member of the Committee Board of GEAM Association (“Associazione Georisorse e Ambiente”) since 2015
- Member of GEAM, Geo-engineering, Environment and Mining Association (Vice-President from 2009 to 2014)
- Member of SOMP, Society of Mining Professors (since 2011)
- Member of the Scientific Board of the Society of Mining Professors (since 2019)
- Ascanio Sobrero Institute on Explosives and Detonics (since 2001)
- EU-Excert “Certifying Expertise in European Explosives Sector”, from 2004-to 2006
- International Organizing Committee “Mine Planning and Equipment Selection” MPES, since 2004
- Member of SME – Society of Mining Engineers (Society for Mining, Metallurgy & Exploration), since 2017.

Official research and teaching and/or fellowship roles, positions as Scholar/ Visiting Professor in international highly qualified universities and research centers

- 2023 – Lecture cycles on excavation techniques in hard rocks, ESPOCH University, Riobamba and Macas, Ecuador, April 2023.
- 2022 – Lecture cycles on Underground Excavations, conventional and mechanized Tunnelling, Indian Institute of Technology (Indian School of Mines) Dhanbad University, Jarkand (India). August 2022.- 2022 - Lecture cycles on topics related to the exploitation of small-scale and artisanal mines, ESPOCH, Riobamba University, Ecuador, May 2022.
- 2019 – Outgoing mobility at University of Lisbon – Erasmus + program (Topic: Drill & Blast)
- Invited lecturer at “Universidad de las Fuerzas Armadas - ESPE, Quito (Ecuador), on the subject: “Excavation by Drill & Blast – System Components”. March 2018.
- 2014-2015 - Special Visiting Professor PVE, on the subject: Integrated Geology and Blasting in the comminution process of a small-scale mine - research activities in the Experimental Mine of the USP Center for Responsible Mining”; research carried out at USP, Universidade Politécnica de São Paulo, Departamento de Engenharia de Minas e de Petroleo, Brazil (from October 10, 2014 to April 5, 2015)
- 2015- Visiting Professor at ITU - Istanbul Technical University, Istanbul, Turkey, experimental research on mechanized excavation in tunnelling, with particular reference to the study of the rock-tool interaction through laboratory tests at different scales (from 01-05-2015 to 30-09-2015
- Invited lecturer at “PPGEM, Departamento de Engenharia de Minas da Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil), on the subject: “Design criteria for production blasting in an Italian underground limestone quarry”. October 2014.
- Invited lecturer at “PPGEM, Departamento de Engenharia de Minas da Universidade Federal do Rio Grande do Sul, Porto Alegre (Brazil), on the subjects: “Evolution of drilling techniques”; “Rock Blasting and over-break control”; “Tunnelling”. April 2012.
- Cycle of seminars at “Pakistan Stone Development Company”, Islamabad (Pakistan), title: “Technologies and equipment for the exploitation of dimension stones”; 3-days talks given to technicians and specialists in the sector of Stones Exploitation. June 2011.
- Invited lecturer at “Ben Gurion University of the Negev, Be'er Sheva (Israel), on the subjects: “Demolition of civil and industrial buildings” e “Monitoring of vibrations induced by Drill & Blast”. December 2011.
- Invited lecturer at CEMEX Trademarks Worldwide Ltd. – Biel, (Switzerland), Title: “Exploration methods and excavation techniques for civil and mining purposes” March 2007
- Invited talk at “Universidad Politécnica de Cartagena y Consejería de Industria y Medio Ambiente de la Comunidad Autónoma de la Región de Murcia (Spain), Title: “ Técnicas de Explotacion de las Rocas Ornamentales en Italia: Racionalización, Desarrollo y Perspectivas ”. March 2007.
- Invited lecturer at “Ecole Nationale Supérieure d'Ingénieurs (ENSI) de Bourges” (France), Title: “Rock Blasting and Environmental Impacts”. April 2004

Participation in international conferences as invited speaker; involvement in the scientific committees of International Conferences

- Member, representative of Italy, of the Tailings Reduction Working Group ICMM (International Council on Mining and Metals) from January 2023.
- Member of the Organizing Committee WTC 2023 (World Tunnel Congress) held in Athens (Greece) on 14-19 May 2023.
- Member of the EFEE (European Federation of Explosives Engineers) and Representative of Italy on the Council Board since 2021.
- Member of the Organizing Committee of EUROCK (Italian Geotechnical Society (AGI), on appointment by the ISRM International Society of Rock Mechanics).
- Member of the “SOMP Council” of the Society of Mining Professors, from 2018 to date.
- President of the 28th Annual Meeting and Conference of the Society of Mining Professors (SOMP), held in Turin on 03-06 July 2017.
- Member of the Organizing Committee of the 24th World Mining Congress, held in Rio de Janeiro (Brazil) on 18-21 October 2016. Referee of the papers in the “Surface Mining” sector.
- Invited speaker at 11th International Symposium on Rock Fragmentation by Blasting (FRAGBLAST11) held in Sydney, Australia, on 24-28 August 2015.
- Invited speaker at the II workshop of ISEE (International Society of Explosives Engineers) UFRGS Brazil, held in Porto Alegre, Brazil, on 24-25 October 2014.

- Member appointed, on the proposal of the National University Council, of the Technical Supervisory Committee of the Ministry of the Interior, Department of Public Security, Office for Police Affairs, Arms and Explosives Area, Rome, from 01-01-2010 to date.
- Member of the Scientific Committee of REMTECH (“Bonifiche dei Siti Contaminati e Riqualificazione del Territorio”) from 01 October 2008 to 31 December 2010.
- Organizer and Editor of the 15th International Symposium on Mine Planning and Equipment and Selection (MPES), held in Turin on 20-22 September 2006.
- Mechanical Excavation Techniques in Mine Development and Production, Colorado School of Mines di Golden (CO, USA), 1989.
- Abattage et creusement à l'explosif: une technique toujours d'avenir, CEIFICI Paris, 1990.
- Abattage à l'explosif, INERIS, Verneuil-en-Halatte (F), 1991.
- International training course on rock blasting, Ecole des Mines d'Alès, 1993.
- Explosives Technologies – Open Pit and Underground Blasting, Queen's University Kingston (Canada), 1993.
- Workshop on “Effective Quarry Blasting Methods” - Academy of Blasting & Explosives Technology, Montville (OH, USA), 2009.
- Workshop on “Evolution of Initiation Systems,” organized by EFEE, Paris, France, May 2019.-

#### Workshops and Seminars

#### Teaching activities

A.Y. 2022-2023 Assignments	
01RWHNW 01RVLNF	<b>Excavation engineering and mining plants</b> (Corso Di Laurea Magistrale In Georesources And Geoenergy Engineering - Torino)
01DPYTP	<b>Ingegneria degli scavi e costruzione di gallerie</b> (Master Univ. Di Il Livello In Progettazione Sostenibile Di Opere Geotecniche E Gallerie - Torino)
02GMWTI	<b>Impianti nei cantieri di scavo a giorno e in sotterraneo</b> (Executive Master In Ingegneria Mineraria Applicata Alle Cave Di Pietre Ornamentali - Carrara)
01TTYRW	<b>Rock blasting and overbreak control</b> (Dottorato Di Ricerca In Ingegneria Civile E Ambientale - Torino)
01TTZRW	<b>Demolition Techniques</b> (Dottorato Di Ricerca In Ingegneria Civile E Ambientale - Torino)
A.Y. 2023-2024 Collaborations	
01RWJNW 01RVONF	<b>Underground works and mining</b> (Corso Di Laurea Magistrale In Petroleum And Mining Engineering (Ingegneria Del Petrolio E Mineraria) - Torino)
05PZFPK	<b>Geology/Safety and civil protection</b> (Corso Di Laurea (Ttpu) In Industrial And Civil Engineering And Architecture - Tashkent-Torino)
01VQRTI	<b>Arte mineraria: scavi a giorno e in sotterraneo</b> (Executive Master In Ingegneria Mineraria Applicata Alle Cave Di Pietre Ornamentali - Carrara)
01VQUTI	<b>La sicurezza delle attività minerarie connesse alle pietre ornamentali</b> (Executive Master In Ingegneria Mineraria Applicata Alle Cave Di Pietre Ornamentali - Carrara)
01DPZTP	<b>Progettazione di gallerie e case histories</b> (Master Univ. Di Il Livello In Progettazione Sostenibile Di Opere Geotecniche E Gallerie - Torino)

The list of assignments from 2001 to 2022 can be examined at the following link:  
[https://didattica.polito.it/pls/portal30/sviluppo.doc.old\\_incarichi](https://didattica.polito.it/pls/portal30/sviluppo.doc.old_incarichi)

The list of collaborations from 2004 to 2022 can be examined at the following link:  
[https://didattica.polito.it/pls/portal30/sviluppo.doc.old\\_collab](https://didattica.polito.it/pls/portal30/sviluppo.doc.old_collab)

#### Other teaching activities

- Riobamba and Macas – ESPOCH, University of Chimborazo. Cycle of lectures in the framework of the REMIND Project (2022 and 2023).
- 2023; 2018 - Member of the International Board for assessing the final activities of Ph.D. students, a Ph.D. program in Mining Engineering, UNSW – University of New South Wales, Sydney.
- 2019 - Member of the International Board for assessing the final activities of Ph.D. students, a Ph.D. program in Mining Engineering, at WITS University, Johannesburg (South Africa).
- President of the technical evaluation committee for a tenure track position of Associate Professor in Raw Materials Engineering (08A2 – ING/IND 29) at Politecnico di Torino University, 2019.
- 2018 – Member of technical evaluation committee for a tenure-track position of Associate Professor in Mining Engineering at Polytechnic University of Catalonia. The evaluation process for this position is

International.

“Mining Engineering Challenge Project 2017” between Politecnico di Torino and UAI-Universidade Adolfo Ibanez (Chile); co-responsible of the teaching project on “Undreground exploitation” (AY 2016-2017)

- “Università degli Studi di Parma”, Engineering Faculty, MSc in Civil Engineering, course of “Gallerie”; invited to held a cycle of classes on the Topic: “Tunnelling: D&B techniques and Mechanical Excavation”; AY 2007-2008, 2010-2011, 2011-2012.

- Master in Tunnelling and Tunnel Boring Machines, Turin - Topics: Drill and blast methods; Blast design and control of induced vibrations; Years: 2003, 2005, 2009; 2011; 2013;

- CINEAS – Politecnico di Milano, Topics: Demolition of Concrete Structures (“Demolizione di strutture in calcestruzzo”); Demolition of steel structures; AY 2009 – 2010

- Master’s in safety engineering and risk Analysis-Module: Safety in temporary and mobile construction sites, COREP, Turin; topic: Excavation and rock splitting technologies; Years: 2000, 2002, 2003, 2004, 2005, 2006; Topic: Structures, techniques, and technologies applicable to excavation and demolition sites

- Member of board of examiners at “Universidad Politécnica de Cartagena” (Spain), (2009); subject of the Ph.D. thesis: Diagnóstico tecnológico del sector de los áridos y su aplicación a la Región de Murcia (Technological diagnosis of the aggregate’s sector and its application at the Murcia (SP) Region).

- Member of board of examiners at Orléans (France) University (2006), [Mechanics-Energetic area]; subject of the thesis: “Impact de fortes explosions sur les bâtiments représentatives d’une installation industrielle” (Impact of strong explosions on industrial buildings).

- Member of board of examiners at Vigo (Spain) University (2006), [environmental technologies area]; subject of the Ph.D. thesis: “Estudio de los parámetros de viabilidad de las canteras subterráneas de mármol (Study of parameters conditioning the road network in underground marble quarries).

- President of the evaluation Committee (Civil-Environmental Section) of the National exam for the qualification of the Engineering profession (“Esami di Stato”), Politecnico di Torino. Year 2014 (I session), Year 2017 (I and II session), Year 2020 (I and II Session), Year 2021 (I and II session), Year 2022 (I and II session).

- Member of the evaluation Committee of the National exam for the qualification of the Engineering profession (“Esami di Stato”), Politecnico di Torino. Years (I and II Session): 2004, 2006, 2008, 2009, 2010, 2011, 2012, 2013, 2016, 2018, 2019.

- Member of internal committees for the awarding of scholarships, research grants, and positions as type A and B researcher.

- Supervisor of more than 250 Bachelor and MSc. thesis. The list is available at the link: [https://didattica.polito.it/pls/portal30/sviluppo.pagina\\_docente\\_2018.main?t=7](https://didattica.polito.it/pls/portal30/sviluppo.pagina_docente_2018.main?t=7)

#### Digital competence

SELF-ASSESSMENT				
Information processing	Communication	Content creation	Safety	Problem solving
Independent user	Proficient user	Proficient user	Basic user	Proficient user

Levels: Basic user - Independent user - Proficient user

[Digital competences - Self-assessment grid](#)

#### Main topics of research

- Mechanical characterisation, at different scales (both geometrical and time-dependant), of rocks
- rock-tool interaction problems
- Simulation and optimisation of fragmentation, mechanical cutting, rock breaking
- Rock blasting
- Industrial explosives for civil demolitions
- Exploitation of dimension stones
- Equipment selection in quarrying
- Controlled blasting: pre-splitting and smooth-blasting optimization; remediation with explosive
- Vibrations and stresses induced by blasting, especially in proximity of sensitive monuments and civil buildings
- Environmental impacts due to the exploitation and/or civil demolition (fly-rocks, dust, noise, etc.)
- Organisation and planning of excavation techniques

- Reuse of wastes and by-products
- Artificial triggering of snow avalanches by explosive (also propellant)

Research area: brief description Main research subjects deal with pertains, broadly speaking, to geo-engineering, and superpose to educational duties, such as the excavation, by means of explosives or mechanical techniques, of rocks, ores, earth, and manmade materials (i.e. demolitions); the crushing, grinding, sizing and beneficiation of raw minerals and rocks, the exploitation of mines and quarries and the related geo-mechanical problems; the recovery of by-products and the disposal of wastes. Attention was paid to the following themes: in the D&B sector, to the development and validation of criteria and rules to calculate charges in view of reaching the optimal effect (controlled fragmentation, displacement effect, accuracy, disturbance reduction, correct selection of the drilling and mucking machinery and so on), to the evaluation of explosives and initiation systems, and to the comparative evaluation of the results obtained; in the mechanical excavation, to the correct rock-tool interaction and to the optimization of operating conditions; in the mine and quarry design, to the equipment selection and adaptation rules. Due to the nature of the subjects, only a limited part of the activity consisted of typical laboratory work. A more important role was paid by field work.

The publication activity covered a great variety of subjects. In this brief report, only some research lines are considered, recently pursued, where valuable results have been attained, and validated by practical applications in the field of civil and mining excavation, demolitions, and valorisation of materials obtained from said activities. The lines are labelled, shortly, as:

- A. Controlled blasting: rational use of explosives in different conditions; in this field, many experimental researches are under development, aimed to the control of the evolution of the excavation geometry (both open pit and underground and, in this last context, both in tunnelling and in production techniques, i.e. "rooms and pillars" and "sublevel stoping"); the same goal is pursued in the field of dimension stones: refinement of the dynamic splitting and techniques of pre-splitting and smooth-blasting are being tested in many Italian quarry-sites, also paying attention to the problems of environmental control (vibration, fly-rocks, dust, noise, etc..)
- B. Vibrations induced by blasting, especially in proximity of sensitive structures; many studies were carried out with the aim to focus on the problem of the environmental impacts due to the exploitation. The best conditions to obtain the desired rock fragmentation (respecting the required production per day) were also defined.
- C. Mechanical cutting of rocks: numerous predictive models are present to determine the parameters that affect the mechanized excavation by means of tools, based on the characteristics of the rock mass and on those of the equipment used. Although widely used, in many cases, these models have limitations in their application and, consequently, in the prediction of the machine parameters for different lithological conditions. For these reasons, the current trend is to carry out experiments of rock excavation with tools at a real scale. In this regard, a Linear Cutting Machine (LCM) has recently designed and implemented, in collaboration with other colleagues of the DIATI, in order to directly acquire influential parameters pertaining to the excavation with disc tools, and to evaluate possible configurations of the most suitable machine.
- D. Mechanical characterisation, at different scales (geometrical and time-dependant), of rocks: the rational approach to problems of interaction rock-explosive, rock-tool, rock-crusher and so on, has been developed by considering: problems of the conceptual connection between the petrographic and the geo-mechanical description of rocks. From these studies, both the usefulness and the possibility of a micro-mechanical description comes out, on the basis of the statistical analysis of hardness tests and, in particular, of micro-hardness tests, parallelly to a conventional description. The inadequacy of the conventional geotechnical description to foresee the rock behaviour in some technological processes involving the production of thin fragments (grinding, cutting by micro-tools and so on) is highlighted; the opportunities of a micro-mechanical analysis and of a small scale geostatistical description are pointed out; the effects of the load application on the mechanical behaviour of rocks (fatigue phenomena) are also taken into account.

#### ADDITIONAL INFORMATION

##### Scientific Papers and books

Author, or co-author, of more than 240 papers, published in devoted magazines or presented at National/International Conferences.

The list of papers indexed on Scopus is available at the link:

<https://www.scopus.com/authid/detail.uri?authorId=7006647992>

December, 2023

(Marilena Cardu)

