

# **Prof. Dr. Ing. Marco Paggi**

**Full Professor of Structural Mechanics**

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## **Biographical sketch and career**

- Born in Novara (NO), 10/12/1977.
- 17/12/2001: Master's degree in Civil Engineering at Politecnico di Torino, 110/110 cum laude.
- 06/05/2005: PhD in Structural Engineering (XVII Cycle) at Politecnico di Torino, where he was recipient of a scholarship from the Italian Ministry of Education, University and Research.
- From 01/01/2005 to 31/7/2007: Post-doctoral research fellow in Structural Mechanics in the Department of Structural and Geotechnical Engineering of Politecnico di Torino.
- From 01/08/2007 to 30/10/2013: Assistant Professor in Structural Mechanics in the Department of Structural and Geotechnical Engineering of Politecnico di Torino, with tenure from 01/08/2010. Aggregate Professor of Structural Mechanics from 2011 to 2013.
- From 01/11/2013 to 27/12/2018: Associate Professor of Structural Mechanics at the IMT School for Advanced Studies Lucca, appointed by a direct call for the recruitment of principal investigators of ERC Starting Grants (Italian Law 04/11/2005, n. 230, art. 1, comma 9, modified by the Italian Law 30/12/2010, n. 240, art. 29, comma 7).
- 13/01/2014: Italian Scientific Habilitation for the position of Associate Professor in Structural Mechanics.
- 28/03/2017: Italian Scientific Habilitation for the position of Full Professor in Structural Mechanics.
- From 28/12/2017: Full Professor in Structural Mechanics at the IMT School for Advanced Studies Lucca.

## **Appointments by other institutions**

- From 01/02/2010 to 31/01/2011: Alexander von Humboldt Research Fellow at the Gottfried Wilhelm Leibniz Universität di Hannover, Germany, Institute of Continuum Mechanics.
- From 10/09/2013 to 09/10/2013: Visiting Professor in Structural Mechanics in the research unit DYSCO (Dynamical Systems, Control and Optimization) of the IMT School for Advanced Studies Lucca, Italy.
- From 28/04/2014 to 31/05/2014: Visiting Full Professor at the Université Paris-EST, Laboratoire de Modélisation et Simulation Multi Echelle, Marne-La-Vallée, France.

- From 29/10/2014 to 31/12/2017: Member of the Technical Committee of the Task 13 "Performance and Reliability of Photovoltaic Systems" of the Photovoltaic Power Systems Programme of the International Energy Agency.
- From 14/09/2015 to 17/06/2016: adjunct professor for the course "Mechanics of Masonry Structures and Fracture Mechanics", 25 hours, 2nd year of the Master in Civil Engineering, Università degli Studi di Trento, Italy.
- From 01/10/2015 to 31/10/2015: contract for studies and researches on coupled mechanical problems involving fracture and instabilities in elastic and inelastic solids and structures, conferred by Università degli Studi di Trento, Dipartimento di Ingegneria Civile, Ambientale e Meccanica, Trento, Italy.
- From 01/04/2016 to 30/04/2016: contract for studies and researches on numerical methods for nonlinear fracture mechanics, conferred by Università degli Studi di Trento, Dipartimento di Ingegneria Civile, Ambientale e Meccanica, Trento, Italy.
- From 28/09/2016 to 24/09/2017: adjunct professor for the course "Structural mechanics and structural design", 60 hours, 3rd year of the Bachelor degree in Chemical Engineering, Università di Pisa.
- From 01/06/2017 to 30/06/2017: contract for studies and researches on numerical techniques for mechanics of materials, conferred by Università degli Studi di Trento, Dipartimento di Ingegneria Civile, Ambientale e Meccanica, Trento, Italy.
- From 25/09/2017 to 21/09/2018: adjunct professor for the course "Structural mechanics and structural design", 60 hours, 3rd year of the Bachelor degree in Chemical Engineering, Università di Pisa.

### **Coordination activities**

- From 26/06/2009 to 03/07/2013: elected member of the Executive Board of the Italian Group of Fracture (2 consecutive appointments).
- From 01/11/2013: Director of the research unit "MUSAM - Multi-scale Analysis of Materials", IMT School for Advanced Studies Lucca (<http://musam.imtlucca.it/>) and Director of the experimental laboratory MUSAM-Lab (<https://www.imtlucca.it/research/laboratories/musam-lab>)
- From 13/12/2013 to 31/12/2015 and from 01/02/2017 to date: elected member of the Academic Council of the IMT School for Advanced Studies Lucca.
- From 22/12/2015: Director's Delegate for Research of the IMT School for Advanced Studies Lucca.
- From 15/02/2016: member of the executive board of the joint Office for Technology Transfer of Scuola Superiore Sant'Anna, Scuola Normale Superiore, Scuola IMT Alti Studi Lucca and Scuola Universitaria Superiore Pavia (JoTTO, Joint Technology Transfer Office, <http://www.jointto.it>)
- From 15/03/2013 to 14/03/2016: Member of the board of professors for the PhD in "Structural Engineering", Politecnico di Torino, A.Y.: 2013/2014 - Cycle: 29.
- From 01/11/2014 to 31/10/2017: Member of the board of professors for PhD in "Institutions, Markets and Technologies", Scuola IMT - Istituzioni, Mercati, Tecnologie - Alti Studi - LUCCA - Cycle: 30.
- From 01/11/2014 to 31/10/2017: Director of the PhD curriculum in "Computational Mechanics" within the PhD "Institutions, Markets and Technologies", Scuola IMT Istituzioni, Mercati, Tecnologie - Alti Studi - LUCCA, Cycle: 30.

- From 01/11/2015 to 31/10/2018: Member of the board of professors for the PhD in "Institutions, Markets and Technologies", Scuola IMT - Istituzioni, Mercati, Tecnologie - Alti Studi - LUCCA - Cycle: 31.
- From 22/01/2016: Member of the Executive Committee of the Mechanics of Materials Group of the Italian Association of Theoretical and Applied Mechanics (AIMETA)
- From 01/11/2016 to 31/10/2019: Member of the board of professors for the PhD in "Institutions, Markets and Technologies", Scuola IMT - Istituzioni, Mercati, Tecnologie - Alti Studi - LUCCA - Cycle: 32.
- From 01/11/2017 to 31/10/2020: Member of the board of professors for the PhDs in "Cognitive and Cultural Systems" and "Systems Science", Scuola IMT - Istituzioni, Mercati, Tecnologie - Alti Studi - LUCCA - Cycle: 33.
- Supervisor of the following researchers and post-doctoral fellows:
  - Dr. Andrea Bacigalupo (assistant professor RTD-A, from 01/01/2015 to date).
  - Dr. Irene Berardone (post-doctoral fellow, from 15/03/2016 to 30/11/2017; afterwards post-doctoral fellow at the University of Bologna).
  - Dr. Francesco Biancalani (post-doctoral fellow, from 01/02/2017 to date).
  - Dr. Claudia Borri (post-doctoral fellow, from 03/02/2014 to date).
  - Dr. Pattabhi R. Budarapu (post-doctoral fellow, from 02/03/2015 to 01/02/2017; afterwards tenure-track assistant professor in the School of Mechanical Sciences, Indian Institute of Technology Bhubaneswar, Bhubaneswar, India).
  - Dr. Ing. Francesca Fantoni (post-doctoral fellow, from 01/03/2016 to 28/02/2017; afterwards post-doctoral fellow at the University of Brescia).
  - Dr. Mariacristina Gagliardi (post-doctoral fellow, from 18/11/2015 to date).
  - Dr. Pietro Lenarda (post-doctoral fellow, from 01/11/2016 to 17/09/2017; afterwards post-doctoral fellow at the Italian Institute of Technology (IIT) Genova).
  - Dr. Lorenzo Morini (post-doctoral fellow, from 18/01/2016 to 16/12/2016; afterwards Marie Curie Fellow at the School of Engineering, Cardiff University, UK).
  - Dr. Saheed O. Ojo (post-doctoral fellow, from 15/03/2016 to 30/11/2017; afterwards post-doctoral fellow at the University of Limerick, UK).

## Editorial appointments

- **Member** of the **Editorial Board** of the journal **Computers, Materials & Continua** (Tech Science Press), since March 2018.
- **Founding Associate Editor** of **Frontiers in Mechanical Engineering**, Section Tribology, since March 2018.
- **Contributing Editor** of the journal **Mechanics of Advanced Materials and Structures** (Taylor & Francis), since 2017.
- **Member** of the **Editorial Board** of the **International Journal of Solids and Structures** (Elsevier), since February 2016.
- **Member** of the **Editorial Board of Scientific Reports** (Nature Publishing Group), Chemical Physics section, since May 2015.

- **Associate Editor of the Journal of Mechanical Engineering Science** (Proceedings of the Institution of Mechanical Engineers, Part C, SAGE), Materials, Stress Analysis & Structures section, since November 2014.
- **Member of the Editorial Board of the American Journal of Engineering and Applied Sciences**, since January 2015.
- **Review Editor of the Journal Frontiers of Mechanics of Materials**, since 2014. <http://community.frontiersin.org/people/MarcoPaggi/153547>
- **Member of the Editorial Board of The Journal of Strain Analysis for Engineering Design** (SAGE), since November 7, 2011.
- **Member of the Review Board of the Journal Fracture and Structural Integrity**, since August 2009.
- **Guest editor** of the special issue of the journal *Meccanica* (Springer) Vol. 53 (3), February 2018, entitled: Recent Advances on the Mechanics of Materials. Co-guest editors: L. Bardella (Università di Brescia) and P. Vena (Politecnico di Milano), doi: 10.1007/s11012-017-0803-1
- **Guest editor** of the special issue of the Journal of Strain Analysis for Engineering Design (SAGE) Vol. 51 (4), May 2016, entitled: Special Issue on the EUROMECH Colloquium 575. Co-guest editor: D.A. Hills (Università di Oxford), doi: 10.1177/0309324716642941.
- **Guest editor** of the special issue of the journal Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science (SAGE) Vol. 230 (9), May 2016, entitled: Special Issue on EUROMECH 575. Co-guest editor: D.A. Hills (Università di Oxford), doi: 10.1177/0954406216635330.
- **Managing Guest-Editor** of the special issue "Fracture and Contact Mechanics for Interface Problems" [Engineering Fracture Mechanics, Vol. 80, 1-2, 2012, doi: 10.1016/j.engfracmech.2012.01.002]. Co-guest editors: A. Carpinteri (Politecnico di Torino, Italy) and P. Wriggers (University of Hannover, Germany).
- **Managing Guest-Editor** of the special issue "Computational Methods for Interface Mechanical Problems" [Computational Mechanics, Vol. 50, 3, 2012, doi: 10.1007/s00466-012-0771-1]. Co-guest editors: A. Carpinteri (Politecnico di Torino, Italy) and P. Wriggers (University of Hannover, Germany).

## Honours and awards

- Short biography included in *Cartaditalia* n. 3 "New frontiers of scientific research in Italy" published by Istituto Italiano di Cultura, Bruxelles, in Italian, French, English and Dutch.
- March 2013 - Nominated member of the **Young Academy of Europe**.
- March 2012 - **Scholarship from ABMEC** (Brazilian Association for Computational Methods in Engineering) for the participation in the 10th World Congress of Computational Mechanics, July 8-13, 2012, San Paolo, Brasil.
- 2008, 2009, 2010 & 2011 - **Award for Outstanding Scientific Activity of a Young Researcher**, conferred by Politecnico di Torino (2008: 5th position among all faculty members younger than 40; 2009: 2nd position; 2010: 1st position; 2011: 1st position).

- **Prize for Outstanding Collaboration of a Visiting Researcher** (Auszeichnung für hervorragende Zusammenarbeit als Gastwissenschaftler), conferred by the Freundeskreis der Leibniz Universität Hannover, Sektion Mechanik, January 2011.
- January 2010 - Recipient of the **Fellowship of the Alexander von Humboldt Foundation**. The AvH sponsorship is limited to those individuals who have demonstrated outstanding achievements in research and who contribute significantly to international cooperation and understanding.
- **ESIS Young Scientist Award 2010**, conferred by the European Structural Integrity Society. The purpose of the Young Scientist Award is to recognize individuals younger than 40 who have made distinguished, innovative work in fracture mechanics in their early career. The award was given to Dr. Paggi: "For outstanding contributions to fracture mechanics, and particularly in fatigue scaling, friction effects and nonlinear crack modelling".
- **Prize for Young Authors IGF 2009** conferred by the Italian Group of Fracture (IGF) for the paper entitled "Fatigue of quasi-brittle materials: a unified interpretation of microstructural size, crack size and size-scale effects".
- Selected by a joint ESF-ALLEA review panel as one of the 21 attendees to the ESF-ALLEA Forum "**Humanities Spring 2009 I**" that led to the statute of the Young Academy of Europe (Vienna, 8-10 June, 2009).
- Prize "**Premio Optime**" for the best young graduates of the year, conferred by the Industrial Union of Turin, in collaboration with the Turin University and Politecnico di Torino (2002).

### Coordination and management of research projects

- From 01/03/2018 to 28/02/2020: Coordinator of a research unit for the **POR FESR 2014/2020** – action 1.1.5 sub-action a1 - Call 1, Strategic Projects of Research and Development "GlycoG-Lab 4.0", 2,500,575 Euro, 24 months.
- From 15/03/2018 to 14/03/2020: Principal investigator of the **MIUR-DAAD Joint Mobility Program 2017** "Multi-scale modeling of friction for large scale engineering problems". The project, in collaboration with Prof. Dr.-Ing. A. Popp (Bundeswehr Universität Munich) is granted by the Italian Ministry of Education, University and Research (MIUR), and the Deutscher Akademischer Austausch Dienst (DAAD), 40,000 Euro, 24 months.
- From 01/03/2018 to 28/02/2020: Principal investigator of a project **POR FSE 2014-2020**: financial support for 1 two-years post-doctoral research fellowship, co-funded by Tuscany Region and by the company CROMOLOGY ITALIA spa (Porcari, Lucca, Italia), 54,000 Euro, 24 months.
- From 01/06/2016 to 31/12/2017: Coordinator of a research unit (Scuola IMT Alti Studi Lucca) for the project "Brilliant Researchers Impact on Growth Health and Trust in research" (grant agreement 722944), Research Executive Agency (Brussels), **H2020 call Marie Skłodowska-Curie COFUND**, Researchers' Night and Individual Fellowships Global, 180,000 Euro (10,000 Euro for Scuola IMT Alti Studi Lucca), 20 months.
- From 01/01/2017 to 30/06/2018: Principal investigator of the **ERC Proof of Concept 2016** PHYSIC "Photovoltaics with superior crack resistance", granted by the European Research Council, 149.500 Euro, 18 months.
- From 01/12/2012 to 30/11/2017: Principal investigator of the **ERC Starting Grant 2012** "Multi-field and multi-scale Computational Approach to design and durability of PhotoVoltaic Modules" (grant agreement 306622), European Research Council (Brussels), FP7 call ERC-2012-StG\_20111012, 1,483,980 Euro, 60 months.

- From 07/03/2012 to 06/03/2016: Principal investigator of the project **FIRB Future in Research 2010** "Structural mechanics models for renewable energy applications" (RBFR107AKG), MIUR (Roma), 954,800 Euro, 48 months.
- From 01/01/2011 to 31/12/2012: Principal investigator of the **Italy-Germany Vigoni project 2010** "3D modelling of crack propagation in polycrystalline materials", Ateneo Italo Tedesco (Trento), 5.000 Euro, 24 months. German partner: Prof. Peter Wriggers, Leibniz University Hannover (10,000 Euro from DAAD).

### **Organization of conferences, workshops, summer schools; scientific committee memberships**

- Coordinator (together with D.A. Hills, University of Oxford) and professor of the Advanced Course "Modelling and Simulation of Tribological Problems in Technology", International Centre for Mechanical Sciences (CISM), Udine, Italy, from 28/05/2018 to 01/06/2018.
- Member of the International Scientific Committee of the "Contact Mechanics International Symposium", Oropa, Biella, Italy, from 16-05-2018 to 18-05-2018.
- Invited professor for the second Summer School "Engineering of surfaces, lubrication models, nanotribology, innovative materials" organized by the Italian Association of Tribology, Salerno, Italy, from 28/08/2017 to 01/09/2017.
- Member of the Scientific Committee of the "14th International Conference on Fracture", Rhodes, Greece, from 18-06-2017 to 23-06-2017.
- Member of the Scientific Committee of the "5th International Conference on Computational Modeling of Fracture and Failure of Materials and Structures (CFRAC 2017)", Nantes, Francia, from 14-06-2017 to 16-06-2017.
- Organizer of the workshop "Funding opportunities for young researchers' mobility" in collaboration with Scuola Superiore Sant'Anna, Scuola Normale Superiore and Scuola Universitaria Superiore Pavia, Lucca, 16-02-2017.
- Organizer of the "XXI Convegno Italiano di Meccanica Computazionale e VIII Riunione del Gruppo Materiali AIMETA" (GIMC-GMA 2016), Scuola IMT Alti Studi Lucca, from 27-06-2016 to 29-06-2016.
- Member of the Organizing Committee of the "21st European Conference on Fracture", Catania, Italy, from 20-06-2016 to 24-06-2016.
- Organizer of the workshop "Innovative entrepreneurship in universities. From the idea to the business plan", in collaboration with Scuola Normale Superiore and Scuola Superiore Sant'Anna, Lucca, 16-06-2016.
- Organizer of the workshop "Seminar on metallic and ceramic materials with applications to paper industry", under the patronage of Confindustria Toscana Nord and the support of ASM International, Lucca, 26-05-2016.
- Member of the Scientific Committee of the workshop "Modelling of refractory materials and ceramics, with a view to technological applications", Trento, Italy, 22-04-2016.
- Member of the Organizing Committee of the "IACM Special Interest Conference X-DMS 2015, eXtended Discretization MethodS", Ferrara, Italy, from 09-09-2015 to 11-09-2015.

- Organizer (together with D.A. Hills, University of Oxford) of the EUROMECH Colloquium 575 "Contact Mechanics and Coupled Problems in Surface Phenomena", Scuola IMT Alti Studi Lucca, from 30-03-2015 to 02-04-2015.
- Member of the Scientific Committee of the workshop "State of the art and challenges in thermal and mechanical modelling of ceramic materials", Trento, Italy, 20-03-2015.
- Member of the Organizing Committee of the "XXI Congresso AIMETA di Meccanica Teorica e Applicata", from 17-09-2013 to 20-09-2013.
- Member of the Scientific Committee of the "8th International Conference on Fracture Mechanics of Concrete and Concrete Structures", Toledo, Spain, from 10-03-2013 to 14-03-2013.
- Organizer of the workshop of the Italian Group of Fracture "Virtual Testing of Materials and Structures", Torino, Italy, 08-10-2012.
- Member of the Local Organizing Committee of the IUTAM 2012 Symposium "Fracture phenomena in nature and technology", Brescia, Italy, from 01-07-2012 to 05-07-2012.
- Member of the Organizing Committee of the 11<sup>th</sup> International Conference on Fracture, Torino, Italy, from 20-03-2005 to 25-03-2005.

### **Organizer of mini-symposia and special sessions in conferences**

- **Mini-symposium** "Fracture and Contact Mechanics for Interface Problems", IV European Conference on Computational Mechanics, Paris, 16-21 May 2010, together with A. Carpinteri (Politecnico di Torino) and P. Wriggers (University of Hannover, Germany).
- **Mini-symposium** "Fracture and Contact Mechanics for Interface Problems", 10th World Conference on Computational Mechanics-WCCM10, 8-13 July 2012, San Paolo, Brasil, together with A. Carpinteri (Politecnico di Torino) and P. Wriggers (University of Hannover, Germany).
- **Mini-symposium** "Fracture and Structural Integrity", XXI Congress of the Italian Association of Theoretical and Applied Mechanics, 17-20 September 2013, Torino, together with G. Ferro, D. Firrao (Politecnico di Torino) and A. Spagnoli (University of Parma).
- **Special session** "Multiphysics and multiscale modelling of composites for renewable energy applications", 2013 ECCOMAS Thematic Conference on Smart Materials and Structures, 24-26 June 2013, Torino, together with L. De Lorenzis (University of Salento) and A. Piccolroaz (University of Trento).
- **Mini-symposium** "Computational Contact Mechanics", III South-East European Conference on Computational Mechanics (ECCOMAS Special Interest Conference), 12-14 June 2013, Kos, Greece, together with N. Mões (University of Nantes, France) and G. Ancaix (École Polytechnique Fédérale de Lausanne, Switzerland).
- **Mini-symposium** "Fracture and Contact Mechanics for Interface Problems", WCCM-ECCM-ECFD 2014 Congress, 20-25 July 2014, Barcellona, Spain, together with A. Carpinteri (Politecnico di Torino) and P. Wriggers (University of Hannover, Germany).
- **Session** "Numerical and experimental research on the durability of photovoltaic modules", 1st International Symposium on Energy Challenges and Mechanics, 8-10 July 2014, Aberdeen, UK, together with J. Reinoso (University of Hannover, Germany) and F. Haase (Institute for Solar Energy Research, Hameln, Germany).

- **Session** "Material simulation for energy applications", 1st International Symposium on Energy Challenges and Mechanics, 8-10 July 2014, Aberdeen, UK, together with D. Antoun (Lawrence Livermore National Laboratory, USA), L. De Lorenzis (TU Braunschweig, Germania) and A. Piccolroaz (University of Trento).
- **Special session** "Phase field and enhanced finite element formulations for fracture mechanics", ECCOMAS Thematic Conference on eXtended Discretization MethodS, Ferrara, Italy, 9-11 September 2015, together with T. Rabczuk (University of Weimar, Germany) and J. Reinoso (University of Seville, Spain).
- **Special session** "Advanced multi-physics and multi-scale techniques for modeling inelastic processes in solids: damage, fracture and contact mechanics", European Congress on Computational Methods in Applied Sciences and Engineering, Creta, Greece, 5-10 June 2016, together with J. Reinoso (University of Seville) and M. Corrado (Politecnico di Torino).
- **Invited mini-symposium** "Modelling and simulation of damage and fracture induced by repeated contacts", 5<sup>th</sup> International Conference on Computational Modeling of Fracture and Failure of Materials and Structures CFRAC2017, 14-16 June 2017, together with A. Gravouil (INSA Lyon, Francia) and D.A. Hills (University of Oxford, UK).
- **Mini-symposium** "Mechanics and materials ", XXIII Congresso dell'Associazione Italiana di Meccanica Teorica ed Applicata AIMETA 2017, 4-7 September 2017, Salerno, together with L. Bardella (Università di Brescia) and P. Vena (Politecnico di Milano).
- **Mini-symposium** "Mechanics and reliability of piezoelectric materials", XXIII Congresso dell'Associazione Italiana di Meccanica Teorica ed Applicata AIMETA 2017, 4-7 September 2017, Salerno, together with P.S. Valvo (Università di Pisa).
- **Invited Mini-symposium** "Mechanics of discrete systems (incl. granular media, tribology, scratch, indentation, adhesion)", European Mechanics of Materials Conference, 26-28 March 2018, Nantes, France, together with J.-F. Molinari (École Polytechnique Fédérale de Lausanne, Switzerland).
- **Mini-symposium** "Reaction Diffusion Problems in Mechanics", 10<sup>th</sup> European Solid Mechanics Conference, 2-6 July 2018, Bologna, together with R. Ruiz Baier (University of Oxford) and F. Davi (Università Politecnica delle Marche).
- **Mini-symposium** "Open challenges in the phase field approach to fracture mechanics", 13<sup>th</sup> World Congress in Computational Mechanics, 22-27 July 2018, New York, USA, together with J. Reinoso (University of Seville, Spain).

### **Participation to conferences, keynote lectures**

1. G. Zavarise, M. Borri-Brunetto, M. Paggi "A comparison of the mechanical behavior of microscopical contact models", International Conference on Nonsmooth/Nonconvex Mechanics with Applications in Engineering, Thessaloniki, Greece, from 05-07-2002 to 06-07-2002.
2. G. Zavarise, M. Borri-Brunetto, M. Paggi "Prediction of real contact area for interfacial debonding damage in fibrous composite materials", XVI Congresso AIMETA, Ferrara, Italy, from 09-09-2003 to 12-09-2003.
3. A. Carpinteri, M. Paggi "Interface crack propagation in concrete composites: asymptotic analysis of stress-singularities", 5th International Conference on Fracture Mechanics of Concrete and Concrete Structures, Vail, USA, from 12-04-2004 to 16-04-2004.



4. A. Carpinteri, M. Paggi "Influence of interface bonding strength on brittle crack propagation in bi-material structural components", 15th European Conference of Fracture, Stockholm, Sweden, from 11-08-2004 to 13-08-2004.
5. A. Carpinteri, M. Paggi, G. Zavarise "Theoretical and numerical investigation on internal instability phenomena in composite materials", 11<sup>th</sup> International Conference on Fracture, Torino, Italy, from 20-03-2005 to 25-03-2005.
6. M. Borri-Brunetto, A. Carpinteri, S. Invernizzi, M. Paggi "Micro-slip of rough surfaces under cyclic tangential loading", 4th Contact Mechanics International Symposium, Hannover, Germany, from 04-07-2005 to 06-07-2005.
7. M. Paggi, A. Carpinteri "Multi-material junctions with functionally graded materials", XVII Congresso Nazionale AIMETA, Firenze, Italia, from 11-09-2005 to 15-09-2005.
8. M. Paggi, A. Carpinteri, G. Zavarise "A numerical model for the analysis of decohesion at bi-material interfaces with random properties", XVI Convegno Italiano di Meccanica Computazionale, Bologna, Italy, from 26-06-2006 to 28-06-2006.
9. A. Carpinteri, M. Paggi "Correlation between the Paris' constants based on self-similarity and criticality condition", 16th European Conference of Fracture, Alexandroupolis, Greece, from 03-07-2006 to 07-07-2006.
10. A. Carpinteri, M. Paggi, G. Zavarise "A coupled contact and decohesion analysis of laminated beams", IUTAM Symposium on Computational Contact Mechanics, Hannover, Germany, from 05-11-2006 to 08-11-2006.
11. A. Carpinteri, G. Lacidogna, M. Paggi "On the competition between delamination and shear failure in retrofitted concrete beams and related scale effects", 6th International Conference on Fracture Mechanics of Concrete and Concrete Structures, Catania, Italia, from 17-06-2007 to 22-06-2007.
12. A. Carpinteri, M. Paggi "Are the Paris' law parameters dependent on each other?", XIX Convegno Nazionale del Gruppo Italiano Frattura, Milano, Italy, from 02-07-2007 to 04-07-2007.
13. M. Paggi, G. Zavarise "Snap-back and snap-through instabilities due to contact loss in the stick-slip motion of rough surfaces", XVIII Congresso AIMETA, Brescia, Italy, from 11-09-2007 to 14-09-2007.
14. A. Carpinteri, M. Paggi "A crack-length control scheme for the analysis of snap-back instability in the delamination of strengthened beams", Joint 8th World Congress on Computational Mechanics and 5<sup>th</sup> European Congress on Computational Methods in Applied Science and Engineering, Venezia, Italy, from 30-06-2008 to 04-07-2008.
15. M. Paggi, A. Carpinteri "Analytical correlations between the fatigue properties of engineering materials", International Congress on Theoretical and Applied Mechanics 2008, Adelaide, Australia, from 25-08-2008 to 30-08-2008.
16. A. Carpinteri, M. Paggi "New correlations for the cyclic properties of engineering materials", 17th European Conference on Fracture, Multilevel Approach to Fracture of Materials, Components and Structures, Brno, Czech Republic, from 02-09-2008 to 05-09-2008.
17. M. Paggi "The ILTOF project: outcomes and future perspectives", International Conference on Simulation Based Engineering and Sciences 2008", Venezia, Italy, from 16-10-2008 to 17-10-2008.
18. M. Paggi "Fatigue of quasi-brittle materials: a unified interpretation of microstructural size, crack size and size-scale effects", XX Convegno Nazionale del Gruppo Italiano Frattura, Torino, Italy, from 24-06-2009 to 26-06-2009.
19. M. Ciavarella, M. Paggi, A. Carpinteri "A generalized dimensional analysis approach to fatigue crack growth", (keynote lecture) 12th International Conference on Fracture", Ottawa, Canada, from 12-07-2009 to 17-07-2009.

20. M. Paggi, A. Carpinteri, R. Orta "A unified mathematical formulation for the asymptotic analysis of singular elastic and electromagnetic fields", XIX Congresso AIMETA, Ancona, Italy, from 14-09-2009 to 17-09-2009.
21. M. Paggi, G. Ferro "Applicazioni di meccanica della frattura all'analisi di stabilità delle fessure nelle dighe in calcestruzzo", Giornata di Studio IGF "Problematiche di Frattura nei Materiali per l'Ingegneria", Forni di Sopra (Udine), Italy, from 06-01-2010 to 09-01-2010.
22. M. Paggi, P. Wriggers "A computational homogenization approach for a three-level hierarchical composite material", IV European Conference on Computational Mechanics", Parigi, France, from 16-05-2010 to 21-05-2010.
23. M. Paggi, P. Wriggers "Numerical modelling of intergranular fracture in polycrystalline materials and grain size effects", XXI Convegno Nazionale del Gruppo Italiano Frattura, Cassino, Italy, from 13-06-2011 to 15-06-2011.
24. M. Paggi "Effective elastic properties of heterogeneous materials with imperfect finite thickness interfaces", II International Conference on Computational Contact Mechanics", Hannover, Germany, from 15-06-2011 to 17-06-2011.
25. M. Paggi, G. Ferro, F. Braga "Seismic analysis of concrete gravity dams: nonlinear fracture mechanics models and size-scale effects", 3rd International Workshop on Performance, Protection & Strengthening of Structures under Extreme Loading, Lugano, Switzerland, from 30-08-2011 to 01-09-2011.
26. M. Paggi, J.R. Barber "Thermal contact conductance of rough surfaces: dimensional analysis considerations and computational issues", EUROMECH Colloquium 514 "New Trends in Contact Mechanics, Cargèse, France, from 27-03-2012 to 31-03-2012.
27. A. Carpinteri, M. Paggi "Crack size dependencies of Paris' law, fatigue threshold and fatigue limit: An interpretation based on fractality of crack surfaces", IUTAM 2012 Symposium "Fracture phenomena in nature and technology", Brescia, Italy, from 01-07-2012 to 05-07-2012.
28. M. Paggi, E. Lehmann, C. Weber, A. Carpinteri, P. Wriggers "3D vs. 2D modelling of cracking and plasticity in polycrystalline materials", 10th World Congress on Computational Mechanics, Sao Paulo, Brasil, from 08-07-2012 to 13-07-2012.
29. M. Paggi, A. Carpinteri "A shear transfer model for rough joints based on contact and fracture mechanics", 8th International Conference on Fracture Mechanics of Concrete and Concrete Structures", Toledo, Spain, from 10-03-2013 to 14-03-2013.
30. M. Paggi, A. Saporà "Numerical modelling of microcracking in PV modules induced by thermo-mechanical loads", 3rd International Conference on Crystalline Silicon Photovoltaics, Hamelin, Germany, from 25-04-2013 to 27-04-2013.
31. M. Paggi, J.R. Barber "A parallel solution algorithm for the contact simulation of rough surfaces with large sample size", 3rd South-East European Conference on Computational Mechanics, Kos, Greece, from 12-06-2013 to 14-06-2013.
32. M. Paggi, M. Corrado "Modelling of intergranular and transgranular cracking in polycrystalline silicon solar cells", 6th ECCOMAS Thematic Conference on Smart Structures and Materials, Torino, Italy, from 24-06-2013 to 26-06-2013.
33. M. Paggi "Integrity and durability of photovoltaic modules: An overview of mechanical failure modes", XXII Convegno Nazionale del Gruppo Italiano Frattura, Roma, Italy, from 01-07-2013 to 03-07-2013.
34. M. Paggi, M. Corrado "Quasi-static and dynamic nonlinear crack growth at bi-material interfaces", XII International Conference on Computational Plasticity. Fundamentals and Applications, Barcellona, Spain, from 03-09-2013 to 05-09-2013.

35. M. Paggi "Modelling of cracking in PV modules: Physical aspects and Computational Methods", (lecture su invito) Workshop "Measurements and models for PV-Module analysis", Hameln, Germany, 05-11-2013.
36. M. Paggi, A. Infuso "Flaw tolerance of continuum and discrete mechanical systems: the roles of heterogeneity and nonlocality", (lecture su invito) International Workshop "New Frontiers in Multiscale Modelling of Advanced Materials", Villazzano (Trento), Italy, from 17-06-2014 to 20-06-2014.
37. M. Paggi, I. Berardone, M. Corrado "A coupled thermo-electro-mechanical model for fracture in solar cells", 16th European Conference on Composite Materials", Seville, Spain, from 22-06-2014 to 26-06-2014.
38. M. Paggi, J. Reinoso, R. Rolfes "A compatible solid shell-interface element formulation for debonding of thin-walled structures", Joint 11th World Congress on Computational Mechanics, 5<sup>th</sup> European Conference on Computational Mechanics, 6th European Conference on Computational Fluid Dynamics, Barcellona, Spain, from 20-07-2014 to 25-07-2014.
39. M. Paggi "Modelling and simulation of fracture in classical and hierarchical polycrystalline materials towards the design of super-resistant cutting tools" (invited lecture), Special Interest Seminar on Simulation and Modelling in Hard Materials presso "Euro PM2014 International Powder Metallurgy Congress & Exhibition", Salzburg, Austria, 24-09-2014.
40. M. Paggi "A fully coupled thermo-hygro-mechanical theory for the analysis of diffusive phenomena in photovoltaic modules" (invited lecture), 2nd Workshop "Impact of mechanical and thermal load on the long term stability of PV modules", Hannover, Germany, 03-02-2015.
41. M. Paggi, J. Reinoso "Delamination of functionally graded thin films on elastic substrates", EUROMECH Colloquium 577 "Micromechanics of Metal Ceramic Composites", Stuttgart, Germany, from 02-03-2015 to 05-03-2015.
42. M. Paggi, P. Lenarda "A geometrical multiscale numerical method for coupled hygro-thermo-elastic problems in layered materials", Workshop "State of the art and challenges in thermal and mechanical modelling of ceramic materials", Trento, Italy, 20-03-2015.
43. A. Bemporad, M. Paggi "Optimization algorithms for the solution of the frictionless normal contact between rough surfaces", EUROMECH Colloquium 575 "Contact Mechanics and Coupled Problems in Surface Phenomena", Lucca, Italy, from 30-03-2015 to 02-04-2015.
44. J. Reinoso, M. Paggi "A computational framework for buckling, wrinkling and debonding of functionally graded stiff elastic coatings bonded to soft substrates", CERMODEL2015 Modelling and Simulation meet Innovation in Ceramics Technology, Trento, Italy, from 01-07-2015 to 03-07-2015.
45. A. Bemporad, M. Paggi "Optimization algorithms for a fast solution of contact problems with BEM", 9th European Solids Mechanics Conference, Madrid, Spain, from 06-07-2015 to 10-07-2015.
46. M. Paggi, M. Corrado, J. Reinoso "A fully implicit computational approach to dynamic delamination under large displacements", 6th International Conference on Mechanics and Materials in Design (M2D2015), Ponta Delgada, Portugal, from 26-07-2015 to 30-07-2015.
47. M. Paggi "Multi-physics modelling of photovoltaic laminates", XXII Congresso di Meccanica Teorica e Applicata, Genova, Italy, from 14-09-2015 to 17-09-2015.
48. M. Paggi "Multi-scale and multi-field modelling and testing of photovoltaic modules" (invited keynote lecture), Workshop on Multi-Scale and Multi-Physics Testing, Berlin, Germany, from 18-02-2016 to 19-02-2016.
49. P.R. Budarapu, J. Reinoso, M. Paggi "A phantom node method for solid shells to simulate multiple cracking in thin layers made of quasi-brittle materials", Workshop Modelling of refractory materials and ceramics, with a view to technological applications, Trento, Italy, 22-04-2016.

50. A. Gizzi, M. Paggi "Computational modeling of contact interactions between active deformable cells", VII European Congress on Computational Methods in Applied Sciences and Engineering, Crete, Greece, from 05-06-2016 to 10-06-2016.
51. M. Paggi, A. Gizzi "A computational framework for nonlinear contact between deformable excitable biological cells", 24th International Congress of Theoretical and Applied Mechanics, Montreal, Canada, from 21-08-2016 to 26-08-2016.
52. M. Paggi "Micromechanics and deformable excitable biological cells: A new research arena for contact mechanics" (invited keynote lecture), Micro/Nanoscale Models for Tribology, Lorentz Centre, Leiden, The Netherlands, from 30-01-2017 to 03-02-2017.
53. M. Paggi "Guidelines for EL outdoor Qualification of PV Systems" (invited lecture), Intersolar Europe Conference and Exhibition, 30-05-2017, Munich, Germany.
54. M. Paggi, J. Reinoso "Computational methods for fracture and contact at interfaces: cohesive zone model, phase field approach, micromechanics" (invited keynote lecture), 5<sup>th</sup> International Conference on Computational Contact Mechanics, Lecce, Italy, from 05-07-2017 to 07-07-2017.
55. M. Paggi, J. Reinoso "A framework for the interaction between the phase field approach for brittle fracture and the cohesive zone model", CERMODEL 2017, Trento, Italy, from 26-07-2017 to 28-07-2017.
56. M. Paggi, J. Reinoso "A framework for the interplay between the phase field approach for brittle fracture and the interface cohesive zone model", XXIII Congresso dell'Associazione Italiana di Meccanica Teorica ed Applicata, Salerno, Italy, from 04-09-2017 to 07-09-2017.

### **Invited seminars at universities and research centers**

1. "Crack penetration or deflection at an interface: a new framework based on the phase field approach for brittle fracture and the interface cohesive zone model", Università degli Studi di Trento, 01-06-2017.
2. "Durability of photovoltaics modules: modeling, simulation and experiments", Colloquia Doctoralia, Politecnico di Milano, 09-03-2017.
3. "Durability of photovoltaics modules: modeling, simulation and experiments", Department of Engineering Information, Università di Pisa, 26-10-2016.
4. "Computational methods for interface mechanical problems", PhD School in Engineering "Leonardo da Vinci", Università di Pisa, 15-04-2016.
5. "Durability of photovoltaics modules: physical modeling, experimental testing and novel simulation methods", Università degli Studi di Trento, Italy, 16-03-2016.
6. "Numerical methods for thermo-mechanics, fluid-structure interaction, and failure analysis", Istituto Nazionale di Fisica Nucleare, Laboratori Nazionali del Sud, Catania, Italy, from 03-12-2015 to 05-12-2015.
7. "Multi-field and multi-scale computational approach to design and durability of photovoltaic Modules: project overview and achievements", Joint Research Centre JRC, Ispra, Italy, 21-10-2015.
8. "Computational methods for nonlinear fracture mechanics problems with large displacements", Università degli Studi di Trento, Italy, 28-09-2015.
9. "Multi-physics Modelling of Photovoltaic Laminates", MUSIC Graduate School "Multiscale Methods for Interface Coupling" of the Leibniz University di Hannover, Germany, 18-05-2015.
10. "New trends in computational modelling of interfaces", Università Campus Bio-Medico di Roma, Italy, 15-05-2015.

11. "Funding opportunities for PhD students and post-docs", for the PhDs of the Department of Civil, Chemical and Environmental Engineering of the University of Genova, 12-02-2015.
12. "Nonlinear fracture dynamics of laminates with finite thickness adhesives", Grupo de Elasticidad y Resistencia de Materiales dell'Università di Siviglia, Spain, 27-06-2014.
13. "Multi-physics modelling of cracking in quasi-brittle materials for energy applications", Solid and Structural Mechanics Group dell'Università degli Studi di Trento, Italy, 18-06-2014.
14. "Quantitative analysis of cracking in in photovoltaic modules using a multi-physics approach", Institute of Solar Energy Research della Leibniz University di Hannover, Hamelin, Germany, from 29-05-2014 to 06-06-2014.
15. "Multi-scale and multi-physics models applied to interface problems", Université Paris-Est Marne-la-Vallée, France, 16-05-2014.
16. "Fracture dynamics of laminates with finite thickness interfaces", Université Paris-Est Marne-la-Vallée, France, 29-04-2014.
17. "Mechanical challenges in the durability of photovoltaic modules", Technical University of Berlin, Germany, 17-12-2013.
18. "Recent advances of interface constitutive laws for Fracture Mechanics", Seminar at the Institute of Structural Mechanics of the Leibniz University of Hannover, Hannover, Germany, from 19 to 23-08-2013.
19. "Prospettive di ricerca nell'ambito della meccanica computazionale", IMT Institute for Advanced Studies, Lucca, Italy, 09-05-2013.
20. "Emergent properties in interface mechanical problems: A paradigm of organized complexity", IMT Institute for Advanced Studies, Lucca, Italy, 05-03-2013.
21. "Physical modelling and computational strategies for 2D and 3D cohesive fracture and recent progresses towards multi-physics", University of Paris-EST, Marne-La-Vallée, France, 21-25/01/2013.
22. "Length scales in fracture mechanics of heterogeneous and hierarchical materials: the role of imperfect interfaces on the scaling of material properties", Lecture at the Workshop Multiscale Methods for Interface Coupling (MUSIC) International Research Training Group in St. Anton, Austria, 12-16/12/2011.
23. "Length scales in contact mechanics of rough surfaces: scaling of real contact area and thermal contact conductance", Lecture at the Workshop Multiscale Methods for Interface Coupling (MUSIC) International Research Training Group in St. Anton, Austria, 12-16/12/2011.
24. "Normal and tangential contact between rough surfaces: mathematical aspects and numerical treatment", Institute of Computational Science of the University of Lugano, Switzerland, 07/12/2011.
25. "Length scales in contact mechanics and their effects on tribological properties", Laboratoire de Simulation en Mécanique des Solides, École Polytechnique Fédérale de Lausanne, Switzerland, 14/04/2011.
26. "A nonlocal cohesive zone model for finite thickness interfaces: mathematical formulation, numerical implementation and materials science applications", Department of Structural Mechanics, Università di Pavia, Italy, 08/04/2011.
27. "Analogy between singular elastic and electromagnetic fields at multimaterial wedge tips and applications to metamaterials", Department of Engineering Science, University of Oxford, UK, 28/02/2011.

28. "Zusammenarbeit und Forschungsaktivitäten an dem Institut für Kontinuumsmechanik", Institut für Dynamik und Schwingungen, Leibniz Universität Hannover, Germany, 28/01/2011.
29. "Constitutive modelling of finite thickness interfaces: a computational approach based on molecular dynamics, damage mechanics and nonlinear fracture mechanics", ETH Zurich, Switzerland, 12/01/2011.

## **Technology transfer**

- From 15/02/2016: Member of the executive board of the joint Technology Transfer Office of Scuola Superiore Sant'Anna, Scuola Normale Superiore, Scuola IMT Alti Studi Lucca and Scuola Universitaria Superiore Pavia (JoTTO, Joint Technology Transfer Office, <http://www.jointto.it>)
- From 2016: technology transfer contracts with a value above 20.000 Euro with the following companies: Tacchificio Villa Cortese srl, Euro Inn Advisory srl, CIEFFEPI srl; POR-FSR and POR-FESR strategic research and development projects in collaboration with CROMOLOGY Italia spa, for more than 2.500.000 Euro.
- Industrial collaboration with Applied Materials srl (Olmi di S. Biagio di Callalta, Bologna, Italia) and Jabil Industrial and Energy (San Petersburg, Florida, USA) on research topics leading to the following joint publications:
 

M. Paggi, M. Martire, I. Berardone (2016) An electric model of cracked solar cells accounting for distributed damage caused by crack interaction, *Energy Procedia*, 92:576-584, doi: 10.1016/j.egypro.2016.07.22

V. Gade, N. Shiradkar, M. Paggi, J. Opalewski (2015) Predicting the long term power loss from cell cracks in PV modules. *IEEE 42nd Photovoltaic Specialist Conference (PVSC)*, from 14 to 19 June 2015, New Orleans (USA), p. 1-6, doi: 10.1109/PVSC.2015.7355665

## **Board of trustees and peer-review activities**

Evaluator for the following institutions:

- Ministero dell'Istruzione, dell'Università e della Ricerca (MIUR)
- Agenzia Nazionale di Valutazione del Sistema Universitario e della Ricerca (ANVUR)
- UK Engineering and Physical Sciences Research Council
- Deutscher Akademischer Austausch Dienst (DAAD)
- National Council for Scientific Research of Romania
- Croatian Ministry of Science, Education and Sports
- Czech Science Foundation
- Tromsø Research Foundation, Norvegia

2014: Member of a committee of the IMT School for Advanced Studies Lucca for the selection of 1 assistant professor RTD-A in Structural Mechanics and 1 assistant professor RTD-A in Automatics.

2016: Member of a committee of the University of Trento for the selection of 1 assistant professor RTD-A in Structural Mechanics.

2016: Member of a committee of the National Research Council for the selection of 5 permanent researchers in the industrial and civil areas.

Expert reviewer (invited) for Mathematical Reviews, American Mathematical Society (AMS).

Reviewer for the following international journals:

- Nature Publishing Group (1): Scientific Reports.
- Elsevier (19): Journal of Mechanics and Physics of Solids, International Journal of Solids and Structures, Computational Material Science, Finite Elements in Analysis and Design, Engineering Fracture Mechanics, Composite Structures, Tribology International, International Journal of Mechanical Sciences, Mechanics of Materials, Wear, International Journal of Non-Linear Mechanics, Mechanics Research Communications, Computers and Mathematics with Applications, Mathematical and Computer Modelling, Computers & Structures, European Journal of Mechanics – A/Solids, Experimental Mechanics, Journal of the European Ceramic Society, Theoretical and Applied Fracture Mechanics.
- Springer (10): Computational Mechanics, Meccanica, Materials and Structures, International Journal of Fracture, International Journal of Concrete Structures and Materials, Journal of Engineering Mathematics, Computational Mechanics, Rock Mechanics and Rock Engineering, Journal of Zhejiang University – Science A, Lecture Notes in Applied and Computational Mechanics.
- ASME (3): Journal of Fluids Engineering, Journal of Applied Mechanics, Journal of Tribology.
- ASCE (1): Journal of Engineering Mechanics.
- SAGE (4): The Journal of Strain Analysis for Engineering Design; Proc. Inst. Mech. Engng., Part B: J. Engineering Manufacture; Proc. Inst. Mech. Engng., Part C: J. Mech. Engng. Science, Proc. Inst. Mech. Engng., Part J: J. Engineering Tribology.
- Mathematical Sciences Publishers (1): Journal of Mechanics of Materials and Structures.
- Wiley (1): International Journal for Numerical and Analytical Methods in Geomechanics.
- Blackwell (1): Strain – An International Journal for Experimental Mechanics.
- Taylor and Francis (1): Mechanics of Advanced Materials and Structures.
- The Electromagnetics Academy (2): Journal of Electromagnetic Waves and Applications, Progress in Electromagnetic Research.
- Oxford University Press (1): The Quarterly Journal of Mechanics & Applied Mathematics.
- IOP Science (3): Modelling and Simulation in Materials Science and Engineering, Journal of Physics D: Applied Physics, Smart Materials and Structures.
- Other publishers (7): Structural Engineering International (IABSE), Indian Journal of Engineering & Materials Sciences (Indian National Science Academy), Maejo International Journal of Science and Technology (Maejo University, Thailand), Structural Engineering and Mechanics (Techno Press), Multidiscipline Modeling in Materials and Structures (Brill), Entropy (MDPI Publishing), Metals (MDPI Publishing)

## **Teaching portfolio**

### **Teaching activities for bachelor and master's degrees**

A.Y. 2017/2018

**Scienza e tecnica delle costruzioni**, Bachelor in Chemical Engineering, Università di Pisa, Pisa, Professor, 60 hours.

A.Y. 2016/2017

**Scienza e tecnica delle costruzioni**, Bachelor in Chemical Engineering, Università di Pisa, Pisa, Professor, 60 hours.

A.Y. 2015/2016

**Meccanica delle strutture murarie e della frattura**, Master degree in Civil Engineering, Università degli Studi di Trento, Trento, Professor, 25 hours.

A.Y. 2012/2013

**Theory and design of structures**, Bachelor in Architecture, II Facoltà di Architettura del Politecnico di Torino, Torino, Professor of the course delivered in English, 60 hours.

**Strutture**, Master in Architecture, II Facoltà di Architettura del Politecnico di Torino, Torino, Professor, 60 hours.

A.Y. 2011/2012

**Strutture**, Master degree in Architecture, II Facoltà di Architettura del Politecnico di Torino, Torino, Professor, 60 hours.

**Plasticità e frattura**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 3 hours.

A.Y. 2010/2011

**Structural and applied mechanics**, Bachelor in Textile Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Biella, Professor of the course delivered in English, 56 hours.

**Plasticità e frattura**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 3 hours.

A.Y. 2009/2010

**Scienza delle costruzioni II**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 34 hours.

**Teoria delle strutture**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 4 hours.

A.Y. 2008/2009

**Meccanica dei materiali e della frattura**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 18 hours.

**Scienza delle costruzioni II**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 54 hours.

**Teoria delle strutture**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 4 hours.

A.Y. 2007/2008

**Meccanica dei materiali e della frattura**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 16 hours.

**Scienza delle costruzioni II**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 32 hours.

**Teoria delle strutture**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 4 hours.

A.Y. 2006/2007

**Meccanica dei materiali e della frattura**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 18 hours.



**Scienza delle costruzioni II**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 28 hours.

**Teoria delle strutture**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 4 hours.

A.Y. 2005/2006

**Meccanica dei materiali e della frattura**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 20 hours.

**Scienza delle costruzioni II**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 32 hours.

**Teoria delle strutture**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 6 hours.

A.Y. 2004/2005

**Meccanica dei materiali e della frattura**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 18 hours.

**Scienza delle costruzioni II**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 12 hours.

**Modelli meccanici dei materiali e strutture biologiche**, Master in Biomedical Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 6 hours.

A.Y. 2003/2004

**Scienza delle costruzioni**, Master in Civil Engineering, II Facoltà di Ingegneria del Politecnico di Torino, Vercelli, Collaborator, 9 hours.

**Scienza delle costruzioni A**, Bachelor in Electrical Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Alessandria, Collaborator, 64 hours.

**Scienza delle costruzioni B**, Bachelor in Electrical Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Alessandria, Collaborator, 64 hours.

**Scienza delle costruzioni D**, Master in Civil Engineering, I Facoltà di Ingegneria del Politecnico di Torino, Torino, Collaborator, 6 hours.

### **Advisor or bachelor and master's theses**

2015 – Fulvio Savarino, Analisi del danno in moduli fotovoltaici soggetti a impatti, Tesi di Laurea Specialistica in Ingegneria Civile, I Facoltà del Politecnico di Torino, Torino.

2013 – Davide Leone, Modelling the viscoelastic behaviour of materials used in photovoltaic modules, Tesi di Laurea Specialistica in Ingegneria Civile, I Facoltà del Politecnico di Torino, Torino.

2010 – Giusemaria Goso, Effetti di scala sulle curve di interazione per elementi in c.a., Tesi di Laurea in Ingegneria Civile, I Facoltà del Politecnico di Torino, Torino.

2009 – Sara Arlone, Modellazione meccanica degli elementi strutturali realizzati con materiali innovativi: I calcestruzzi fibrorinforzati e i placcaggi con fibre di carbonio, Tesi di Laurea Specialistica in Ingegneria Civile, II Facoltà del Politecnico di Torino, Vercelli.

2009 – Gianfranco Piana, Analisi unitaria di instabilità di ponti sospesi: interazione tra svergolamento e risonanza, Tesi di Laurea Magistrale in Ingegneria Civile, I Facoltà del Politecnico di Torino, Torino.

2008 – Barbara Negri, Fenomeni di biforcazione dell'equilibrio elastico nelle strutture reticolari, Tesi di Laurea Magistrale in Ingegneria Civile, I Facoltà del Politecnico di Torino, Torino.

2008 – Gregorio Rossello, Interaction between buckling and resonance instabilities in suspension bridges: theoretical and numerical study, Tesi di Laurea in Ingegneria Civile, I Facoltà del Politecnico di Torino, Torino.

2007 – Erica Cadamuro, Effetti di scala sulla duttilità degli elementi in calcestruzzo armato, Tesi di Laurea in Ingegneria Civile, I Facoltà del Politecnico di Torino, Torino.

2007 – Andrea Palano, Analisi non lineare dello stato tenso-deformativo: applicazioni alle coperture reticolari, Tesi di Laurea in Ingegneria Civile, I Facoltà del Politecnico di Torino, Torino.

2005 – Andrea Bormida, Processi di perforazione in rocce e calcestruzzo: l'impiego di materiali compositi e gerarchici, Tesi di Laurea in Ingegneria Civile, I Facoltà del Politecnico di Torino, Torino.

### **Teaching activities for the doctoral degree**

A.Y. 2017/2018

**Courses for the PhD in "Systems Science", Scuola IMT Alt Studi Lucca:** "Advanced Topics of Computational Mechanics", together with A. Bacigalupo and A. Gizzi (5 hours over 20); "Computational Contact and Fracture Mechanics" (20 hours); "Micromechanics", together with A. Bacigalupo (5 hours over 10); "Numerical Methods for the Solution of Partial Differential Equations" (20 hours); Long Seminar "Funding and Management of Research and Intellectual Property" (10 hours).

A.Y. 2016/2017

**Courses for the PhD in "Institutions, Markets and Technologies", Scuola IMT Alt Studi Lucca:** "Advanced Topics of Computational Mechanics", together with A. Bacigalupo and P. Budarapu (5 hours over 20); "Computational Contact and Fracture Mechanics" (20 hours); "Micromechanics", together with A. Bacigalupo (5 hours over 10); "Numerical Methods for the Solution of Partial Differential Equations" (20 hours); Long Seminar "Funding and Management of Research and Intellectual Property" (10 hours).

A.Y. 2015/2016

**Courses for the PhD in "Institutions, Markets and Technologies", Scuola IMT Alt Studi Lucca:** "Advanced Topics of Computational Mechanics", together with A. Bacigalupo and P. Budarapu (5 hours over 20); "Computational Contact and Fracture Mechanics" (20 hours); "Micromechanics", together with A. Bacigalupo (5 hours over 10); "Numerical Methods for the Solution of Partial Differential Equations" (20 hours); Long Seminar "Funding and Management of Research and Intellectual Property" (10 hours).

A.Y. 2014/2015

**Courses for the PhD in "Institutions, Markets and Technologies", Scuola IMT Alt Studi Lucca:** "Computational Contact and Fracture Mechanics" (20 hours); "Theory and Numerics of Ordinary and Partial Differential Equations", together with A. Petersen (30 hours over 40); Long Seminar "Funding and Management of Research and Intellectual Property" (10 hours).

A.Y. 2013/2014

**Courses for the PhD in "Institutions, Markets and Technologies", Scuola IMT Alt Studi Lucca:** "Computational Contact and Fracture Mechanics" (20 hours); "Numerical Methods for the Solution of PDEs" (20 hours); Long Seminar "Intellectual Property and Management of Research" (15 hours).

A.Y. 2006/2007

**Collaborator for the course "Meccanica dei Materiali e della Frattura", PhD in Structural Engineering, PhD School of Politecnico di Torino.**

## PhD supervision

- Supervisor of Ing. Irene Berardone, PhD student in Structural Engineering, Politecnico di Torino, Cycle 28: "Fracture Mechanics of Silicon. From durability of photovoltaic modules to the production of thin film solar cells", from 01/03/2013 to 31/03/2016. Afterwards recruited as post-doctoral fellow at the University of Bologna.
- Supervisor of Ing. Saheed Olalekan Ojo, PhD student in Structural Engineering, Politecnico di Torino, Cycle 28: "Thermo-visco-elastic modelling of photovoltaic laminates. Advanced Shear-Lag Theory and Model Order Reduction Techniques", from 01/03/2013 to 31/03/2016. Afterwards recruited as post-doctoral fellow at the University of Limerick, Ireland.
- Supervisor of Ing. Andrea Infuso, PhD student in Structural Engineering, Politecnico di Torino, Cycle 28: "Silicon photovoltaics: experimental testing and modelling of fracture across scales", from 01/03/2013 to 31/03/2016.
- Supervisor of Pietro Lenarda, PhD student in Institutions, Markets and Technologies, Scuola IMT Alti Studi Lucca, Cycle 29: "Modeling and Simulation of a Class of Nonlinear Coupled Reaction-Diffusion Problems for Green Applications", from 01/11/2013 to 30/10/2016. Afterwards recruited as post-doctoral fellow at the Italian Institute of Technology Genova.
- Supervisor of Valerio Carollo, PhD student in Institutions, Markets and Technologies, Scuola IMT Alti Studi Lucca, Cycle 30: "A variational approach to brittle fracture and cohesive delamination: Modelling and technological applications", from 01/11/2014 to 30/10/2017. Afterwards recruited as post-doctoral fellow at the University of Trento.
- Supervisor of Paolo Cinat, PhD student in Institutions, Markets and Technologies, Scuola IMT Alti Studi Lucca, Cycle 30: "Surface roughness genomics in contact mechanics: A new method enabling roughness design towards surface prototyping", from 01/11/2014 to 30/10/2017. Afterwards recruited as post-doctoral fellow at the National Research Council in Florence.
- Currently supervisor of the following PhD students enrolled in the IMT School for Advanced Studies Lucca:
  - Vigneswaran Govindarajan (cycle 30)
  - Rosaria Del Toro (cycle 31)
  - Nicola Dardano (cycle 32)
  - Teresa Guillen Hernandez (cycle 32)
  - Maria Rosaria Marulli (cycle 33)
  - Jacopo Bonari (cycle 33)

## PhD dissertation committee memberships

- 30/03/2017: M. Carfagna "Flow, growth, and remodelling in fibre-reinforced deformable biological tissues and tumour masses", Advisor: A. Grillo, Department of Applied Mathematics, Politecnico di Torino, Italy.
- 09/03/2017: R. Mirzazadeh "Micromechanical characterization of polysilicon thin films: on-chip testing, multi-uncertainty quantification and Bayesian inverse modeling", Advisor: S. Mariani, Dipartimento di Ingegneria Civile e Ambientale, Politecnico di Milano, Italy.
- 08/12/2016: Z. Lv "On the fracture of solar grade crystalline silicon wafer", Advisor: D. Nelias, Institut National de L'Université de Lyon, INSA (France).

- 03/03/2016: M.C. Lo "Interaction of fatigue crack growth and intergranular corrosion in maritime aircraft", Advisor: R. Jones, Monash University (Australia).
- 19/10/2015: M. Vocialta "High performance computing simulations of Dynamic Fragmentation in Brittle Materials", Advisor: J.-F. Molinari, Ecole Polytechnique Fédérale de Lausanne (Switzerland).
- 09/01/2015: P. Budarapu "Adaptive multiscale methods for fracture", Advisor: T. Rabczuk, Bauhaus University of Weimar, Germany.
- 01/12/2014: A.-T. Tran "Modélisation et simulation des interfaces non classiques dans l'écoulement de Stokes et dans les composites élastiques fibreux", Advisor: Prof. Q.-C. He, Université Paris EST (France).
- 27/11/2014: A. Rigazzi "The effects of roughness on the area of contact and on the elastostatic friction", Advisor: Prof. R. Krause, Università della Svizzera Italiana (Switzerland).
- 15/09/2014: I.G. Garcia "Crack initiation in composites at micro and meso scales", Advisor: V.V. Mantic, Università di Siviglia (Spain).
- 16/12/2013: R. Pohrt "Normal stiffness of multiscale rough surfaces in elastic contact", Advisor: V. Popov, Technical University of Berlin (Germany).

## List of publications

Marco Paggi is co-author of 4 didactic books on structural mechanics and thermo-elasticity and of more than 110 articles published in international peer-reviewed journals on the following topics, together with his research group or by international collaborations:

- Theoretical analysis and numerical characterization of singularities in elasticity and in electromagnetism, physico-mathematical analogies and applications to metamaterials and to heterogeneous materials.
- Development of cohesive crack models in statics and dynamics and their numerical treatment: generalization of the cohesive zone model to micro-structured interfaces with fibrils and to finite thickness adhesives; generalized interface finite elements for fracture simulation in finite elasticity; new finite element discretization techniques; study of coupled problems involving fracture and instability in layered materials and in flexible electronics; stability of delamination in FRP-retrofitted arches and beams. *International cooperations*: P. Wriggers (University of Hannover); J. Reinoso, V. Mantic, A. Blazquez (University of Seville); F. Borodich (Cardiff University); R. Rolfes (University of Hannover), P. Areias (University of Evora).
- Development of fracture mechanics formulations for quasi-brittle materials based on the phase-field approach: implementation in solid shell finite elements for nonlinear fracture problems in finite elasticity; development of a new phase field approach combined with the cohesive zone model for the simulation of complex crack patterns involving the interaction between crack growth in the continuum and delamination along pre-existing interfaces; application to composite and polycrystalline materials. *International cooperations*: J. Reinoso (University of Seville); C. Linder (University of Stanford); P. Camanho, A. Arteiro (University of Porto).
- Contact mechanics of rough surfaces: improvement of classic micromechanical contact theories by taking into account elastic interaction between asperities; development of numerical techniques based on the boundary element method and optimization algorithms for the solution of the frictionless normal contact problem; study of the effect of roughness and surface texture on the real contact area, on the apparent coefficient of friction, on leakage, on thermal and electric contact conductances. *International cooperations*: J.A. Greenwood (University of Cambridge), J.R. Barber (University of

Michigan), D.A. Hills (University of Oxford), V. Popov (TU Berlin), Q.-C. He (University of Paris-EST).

- Homogenization techniques for heterogeneous materials: development of computational methods for the identification of higher order continua equivalent to Cauchy heterogeneous materials; applications to piezoelectric materials characterized by thermo-electro-mechanical coupling.
- Experimental monitoring techniques for fracture in Silicon-based photovoltaic modules based on the analysis of infrared and electroluminescence images. *International cooperations*: J. Lopez-Garcia (European Commission, Joint Research Centre, Ispra), V. Gade, N. Shiradkar, J. Opalewski (Jabil Circuit Inc., St. Petersburg, Florida).
- Fatigue crack growth: application of dimensional analysis to fatigue crack growth in materials in order to provide a rationale to the existing semi-empirical correlations and an explanation of their anomalous deviations. *International cooperations*: R. Jones, F. Chen and S. Pitt (Monash University, Australia), O. Plekhov and O. Naimark (Russian Academy of Science, Perm).
- Mechanics of materials-related problems affecting durability of photovoltaic modules: development of multi-scale and multi-field methods to assess the effect of Silicon cracks onto the electric power losses of photovoltaic modules; theoretical and experimental characterization of the thermo-visco-elastic response of EVA polymers based on fractional calculus; modelling and simulation of chemical reactions of diffusion phenomena related to temperature and moisture in photovoltaic laminates with the finite element method; experimental study of an innovative technique to produce ultra-thin solar cells via thermo-elastic spalling. *International cooperations*: S. Kajari-Schroeder (Institute for Solar Energy Research, Hamelin).
- Multi-scale computational fracture mechanics methods: simulation of crack growth in Silicon and graphene with molecular dynamics; development of adaptive multi-scale methods integrating molecular dynamics and finite elements; model order reduction schemes applied to molecular dynamics and heat conduction. *International cooperations*: T. Rabczuk (University of Weimar), B. Javvaji, D. Roy Mahapatra (Indian Institute of Science, Bangalore), G. Zi (Korea University, Seoul).
- Numerical methods for coupled reaction-diffusion problems in solid and fluid mechanics: development of novel fractional time-stepping techniques; application to reaction-advection-diffusion in viscous fluids; contact interaction between cardiac myocytes. *International cooperations*: R. Ruiz-Baier (University of Oxford).
- Compression strength of materials and structures: modeling of crushing in reinforced concrete beams in bending; study of the effect of friction between steel platens and concrete on the apparent compression strength of the material.

## Journal articles

1. Carollo V, Reinoso J, Paggi M (2018) Modeling complex crack paths in ceramic laminates: A novel variational framework combining the phase field method of fracture and the cohesive zone model. *JOURNAL OF THE EUROPEAN CERAMIC SOCIETY*, vol. 38, p. 2994-3003, ISSN: 0955-2219, doi: 10.1016/j.jeurceramsoc.2018.01.035
2. Paggi M, Corrado M, Reinoso J (2018) Fracture of solar-grade anisotropic polycrystalline Silicon: A combined phase field-cohesive zone model approach. *COMPUTER METHODS IN APPLIED MECHANICS AND ENGINEERING*, vol. 330, p. 123-148, ISSN: 0045-7825, doi: 10.1016/j.cma.2017.10.021

3. Casiraghi C, Macucci M, Parvez K, Worsley R, Shin Y, Bronte F, Borri C, Paggi M, Fiori G (2018) Inkjet printed 2D-crystal based strain gauges on paper. CARBON, vol. 129, p. 462-467, ISSN: 0008-6223, doi: 10.1016/j.carbon.2017.12.030
4. Gagliardi M, Paggi M (2018) Long-term EVA degradation simulation: Climatic zones comparison and possible revision of accelerated tests. SOLAR ENERGY, vol. 159, p. 882-897, ISSN: 0038-092X, doi: 10.1016/j.solener.2017.10.081
5. Lenarda P, Paggi M, Ruiz Baier R (2017) Partitioned coupling of advection–diffusion–reaction systems and Brinkman flows. JOURNAL OF COMPUTATIONAL PHYSICS, vol. 344, p. 281-302, ISSN: 0021-9991, doi: 10.1016/j.jcp.2017.05.011
6. Carollo V, Reinoso J, Paggi M (2017) A 3D finite strain model for intralayer and interlayer crack simulation coupling the phase field approach and cohesive zone model. COMPOSITE STRUCTURES, vol. 182, p. 636-651, ISSN: 0263-8223, doi: 10.1016/j.compstruct.2017.08.095
7. Bacigalupo A, Paggi M, Dal Corso F, Bigoni D (2017) Identification of higher-order continua equivalent to a Cauchy elastic composite. MECHANICS RESEARCH COMMUNICATIONS, in press, ISSN: 0093-6413, doi: 10.1016/j.mechrescom.2017.07.002
8. Ojo SO, Ismail SO, Paggi M, Dhakal HN (2017) A new analytical critical thrust force model for delamination analysis of laminated composites during drilling operation. COMPOSITES PART B, vol. 124, p. 207-217, ISSN: 1359-8368, doi: 10.1016/j.compositesb.2017.05.039
9. Reinoso J, Arteiro A, Paggi M, Camanho PP (2017) Strength prediction of notched thin ply laminates using finite fracture mechanics and the phase field approach. COMPOSITES SCIENCE AND TECHNOLOGY, vol. 150, p. 205-216, ISSN: 0266-3538, doi: 10.1016/j.compscitech.2017.07.020
10. Ojo SO, Budarapu PR, Paggi M (2017) A nonlocal adaptive discrete empirical interpolation method combined with modified *hp*-refinement for order reduction of molecular dynamics systems. COMPUTATIONAL MATERIALS SCIENCE, vol. 140, p. 189-208, ISSN: 0927-0256, doi: 10.1016/j.commatsci.2017.08.022
11. Fantoni F, Bacigalupo A, Paggi M (2017) Multi-field asymptotic homogenization of thermopiezoelectric materials with periodic microstructures. INTERNATIONAL JOURNAL OF SOLIDS AND STRUCTURES, vol. 120, p.31-56, ISSN: 0020-7683, doi: 10.1016/j.ijsolstr.2017.04.009
12. Paggi M, Reinoso J (2017) Revisiting the problem of a crack impinging on an interface: a modeling framework for the interaction between the phase field approach for brittle fracture and the interface cohesive zone model. COMPUTER METHODS IN APPLIED MECHANICS AND ENGINEERING, vol. 321, p.145-172, ISSN: 0045-7825, doi: 10.1016/j.cma.2017.04.004
13. Reinoso J, Paggi M, Linder C (2017) Phase field modelling of brittle fracture for enhanced assumed strain shells at large deformations: formulation and finite element implementation. COMPUTATIONAL MECHANICS, vol. 59, p.981-1001, ISSN: 0178-7675, doi: 10.1007/s00466-017-1386-3
14. Corrado M, Infuso A, Paggi M (2017) Simulated hail impacts on flexible photovoltaic laminates: testing and modelling. MECCANICA, vol. 52, p.1425-1439, ISSN: 0025-6455, 10.1007/s11012-016-0483-2
15. Budarapu PR, Reinoso J, Paggi M (2017) Concurrently coupled solid shell based adaptive multiscale methods for fracture. COMPUTER METHODS IN APPLIED MECHANICS AND ENGINEERING, vol. 319, p. 338-365, ISSN: 0045-7825, doi: 10.1016/j.cma.2017.02.023
16. Gagliardi M, Lenarda P, Paggi M (2017) A reaction-diffusion formulation to simulate EVA polymer degradation in environmental and accelerated ageing conditions. SOLAR ENERGY MATERIALS AND SOLAR CELLS, vol. 164, p. 93-106, ISSN: 0927-0248, doi: 10.1016/j.solmat.2017.02.014

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22. Carollo V, Paggi M, Rossani A (2016) A two parameter elasto-plastic formulation for hardening pressure-dependent materials. *MECHANICS RESEARCH COMMUNICATIONS*, p. 1-4, ISSN: 0093-6413, doi: 10.1016/j.mechrescom.2016.07.009
23. Ojo SO, Paggi M (2016) A 3D coupled thermo-visco-elastic shear-lag formulation for the prediction of residual stresses in photovoltaic modules after lamination. *COMPOSITE STRUCTURES*, vol. 157, p. 348-359, ISSN: 0263-8223, doi: 10.1016/j.compstruct.2016.08.036
24. Javvaji B, Budarapu PR, Sutrarakar VK, Mahapatra DR, Paggi M, Zi G, Rabczuk T (2016) Mechanical properties of Graphene: Molecular dynamics simulations correlated to continuum based scaling laws. *COMPUTATIONAL MATERIALS SCIENCE*, vol. 125, p. 319-327, ISSN: 0927-0256, doi: 10.1016/j.commatsci.2016.08.016
25. Lenarda P, Paggi M (2016) A geometrical multi-scale numerical method for coupled hygro-thermo-mechanical problems in photovoltaic laminates. *COMPUTATIONAL MECHANICS*, vol. 57, p. 947-963, ISSN: 0178-7675, doi: 10.1007/s00466-016-1271-5
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JOURNAL OF ENGINEERING TRIBOLOGY, vol. 230, p. 1345-1358, ISSN: 1350-6501, doi: 10.1177/1350650116641017

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34. Ojo SO, Grivet-Talocia S, Paggi M (2015) Model order reduction applied to heat conduction in photovoltaic modules. COMPOSITE STRUCTURES, vol. 119, p. 477-486, ISSN: 0263-8223, doi: 10.1016/j.compstruct.2014.09.008
35. Bemporad A, Paggi M (2015) Optimization algorithms for the solution of the frictionless normal contact between rough surfaces. INTERNATIONAL JOURNAL OF SOLIDS AND STRUCTURES, vol. 69-70, p. 94-105, ISSN: 0020-7683, doi: 10.1016/j.ijsolstr.2015.06.005
36. Borri C, Paggi M (2015) Topological characterization of antireflective and hydrophobic rough surfaces: are random process theory and fractal modeling applicable?. JOURNAL OF PHYSICS. D, APPLIED PHYSICS, vol. 48, p. 1-12, ISSN: 1361-6463, doi: 10.1088/0022-3727/48/4/045301
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38. Paggi M, Reinoso J (2015) An anisotropic large displacement cohesive zone model for fibrillar and crazing interfaces. INTERNATIONAL JOURNAL OF SOLIDS AND STRUCTURES, vol. 69-70, p. 106-120, ISSN: 0020-7683, doi: 10.1016/j.ijsolstr.2015.04.042
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41. Infuso A, Corrado M, Paggi M (2014) Image analysis of polycrystalline solar cells and modelling of intergranular and transgranular cracking. JOURNAL OF THE EUROPEAN CERAMIC SOCIETY, vol. 34, p. 2713-2722, ISSN: 0955-2219, doi: 10.1016/j.jeurceramsoc.2013.12.051
42. Reinoso J, Paggi M (2014) A consistent interface element formulation for geometrical and material nonlinearities. COMPUTATIONAL MECHANICS, vol. 54, p. 1569 -1581, ISSN: 0178-7675, doi: 10.1007/s00466-014-1077-2
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51. Paggi M, Corrado M, Rodríguez MA (2013) A multi-physics and multi-scale numerical approach to microcracking and power-loss in photovoltaic modules. *COMPOSITE STRUCTURES*, vol. 95, p. 630-638, ISSN: 0263-8223, doi: 10.1016/j.compstruct.2012.08.014
52. Paggi M, Lehmann E, Weber C, Carpinteri A, Wriggers P, Schaper M (2013) A numerical investigation of the interplay between cohesive cracking and plasticity in polycrystalline materials. *COMPUTATIONAL MATERIALS SCIENCE*, vol. 77, p. 81-92, ISSN: 0927-0256, doi: 10.1016/j.commatsci.2013.04.002
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In faith,

