

## Curriculum vitae

<b>PERSONAL INFORMATION</b> Beretta Stefano ORCID : <a href="http://orcid.org/0000-0002-0824-8348">http://orcid.org/0000-0002-0824-8348</a> ; Nationality: Italy Date of birth: 07 January 1963 Status: married, 1 daughter and 1 son web site: <a href="http://www.mecc.polimi.it/en/research/faculty/faculty/prof-stefano-beretta/">http://www.mecc.polimi.it/en/research/faculty/faculty/prof-stefano-beretta/</a>	
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### • EDUCATION

- 1997 – Doctoral Degree in Mechanical Engineering at Kyushu University (Fukuoka, Japan) with a dissertation entitled “Behaviour of short fatigue cracks and defect tolerant fatigue design” (tutor Prof. Y. Murakami);  
1988 - MSc Degree in Mechanical Engineering at Politecnico di Milano.

### • POSITIONS

- 2002 – Full Professor of *Machine Design* and *Mechanical Systems Reliability*  
Department of Mechanical Engineering, Politecnico di Milano, Milano, Italy  
1998 – 2002 Associate Professor, Dept. of Mechanical Engineering, Politecnico di Milano.  
1990 - 1998 Researcher, Dept. of Mechanical Engineering, Politecnico di Milano.

### • FELLOWSHIPS AND AWARDS

- 2010 – *ESIS Fellowship*  
2009 - Best Paper Award at ICF12 Conference in Ottawa;

### • SUPERVISION OF GRADUATE STUDENTS AND POSTDOCTORAL FELLOWS

- 2006-2017 9 PhD students, 1 running PhD and 3 PostDocs (1 is now Researcher at PoliMi)  
2008-2017 28 Supervised Master of Science students (no record data by the faculty for the previous years, approx. 3 students per year) for their thesis.

### • TEACHING ACTIVITIES (last 10 years)

Teaching duties are quite heavy at PoliMi, the courses that I have taught in the last 10 years are the course of *Machine Design 2* (10 credits, 180 students) and the course of *Reliability of Mechanical Systems* (6 credits, 60 students). Since 2015, I have been teaching in English language.

### • INSTITUTIONAL RESPONSIBILITIES

- 2013 - 2016 Member of the Academic Senate at Politecnico di Milano;  
2013 - 2014 Examiner of the National Habilitation Committee (for Associate and Full Professor positions) for the disciplines of Machine Construction, Metallurgy and Industrial Design;  
2004 - 2012 Deputy Director of the Department of Mechanical Engineering of Politecnico di Milano.

### • ORGANISATION OF SCIENTIFIC MEETINGS

- 2017 Organizer and Chairman of Int. Symp. Fatigue Design and Material Defect , FDMD3, Lecco (150 exp. part.): <http://www.fdmd3.polimi.it/>  
2015 Co-Chairman of the 15th Int. ASTM E08/ESIS Symposium (Anaheim, CA) on Fatigue and Fracture Mechanics (100 part.)  
2008/2012/2014 Organizer of International Meetings for ESIS Technical Committee TC24 in Milan (approx. 80 part. per meeting);  
2007 Organizer of IGF XIX Conference (Italian Conference on Fracture) held in Milan (approx. 100 part.);  
2005 Member of Organizing Committee of ICF11 Conference (Turin, 2005) (1000 part., organized 2 thematic sessions).

• **SCIENTIFIC SOCIETIES & COMMUNITY SERVICES**

- 2014 - Member of the Editorial Board of *Engineering Fracture Mechanics*.
- 2010 - Chairman of the Technical Committee TC24 (Railway): <http://esiste24.mecc.polimi.it/>
- 2010 - 2014 Vice-President of ESIS (European Structural Integrity Society).
- 2007 - 2011 Member of the Editorial Board of *Journal of Rail and Rapid Transit* (ImechE Trans.).
- 2002 - 2010 Member of the ESIS Executive Committee serving as: Editor of ESIS Newsletter and responsible for the ESIS Website (<http://www.structuralintegrity.eu>).
- 2000 - 2005 Secretary of the ESIS (European Structural Integrity Society) Technical Committee TC20: the activity was mainly concentrated in the years 2002-2003 for the preparation of ESIS P11-02 and for the contribution to the ASTM Standard E2283-03 (in detail, I contributed to writing these documents). The activity of ESIS TC20 was closed in 2005 with a collaborative Round-Robin on the application of E2283-03.

• **SCIENTIFIC COOPERATIONS**

Prof. U. Zerbst (BAM, Germany)	<ul style="list-style-type: none"> <li>- Structural integrity assessment and railway components</li> <li>- Co-tutoring of 2 PhD students</li> <li>- 6 papers published in leading journals</li> </ul>
Prof. H. Sehitoglu (University of Illinois at Urbana-Champaign, IL, US)	<ul style="list-style-type: none"> <li>- Local plasticity and fatigue crack propagation</li> <li>- Co-tutoring of 2 PhD students</li> <li>- 2 papers published in leading journals and 3 papers in international conferences</li> </ul>
Dr. T. Ghidini (European Space Agency, Netherlands)	<ul style="list-style-type: none"> <li>- Fatigue and computational models for the assessment of space components made by AM</li> <li>- Co-tutoring of 1 PhD student supported by ESA under a NPI agreement</li> </ul>
Prof. A. Brueckner-Foit (Kassel University, Germany)	<ul style="list-style-type: none"> <li>- Driving force for short cracks</li> <li>- Visiting and exchange between the two research groups, application to DFG for a Mercator position is envisaged</li> </ul>

• **RESEARCH ACTIVITY**

My scientific activity has addressed different topics: i) mechanical and fatigue behaviour of materials and mechanical components; ii) fitness for purpose and reliability of materials/components in presence of manufacturing defects; iii) multi-axial fatigue crack growth; iv) durability and structural integrity of railway components. Results have been published in 90 journal papers, 130 Conference papers, 1 patent (1 in submission) and 1 monograph.

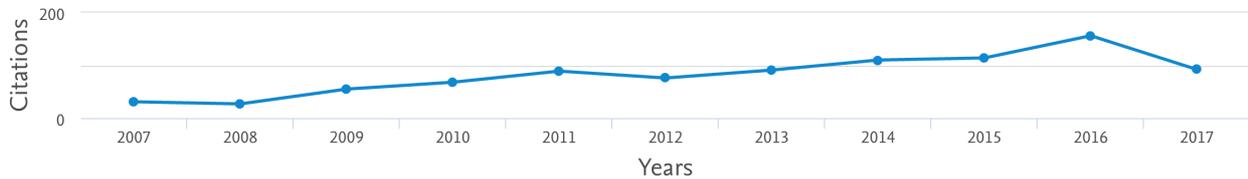
I think that the most successful achievements of my 27 years long career are:

- **new probabilistic and reliability concepts:** I have invented new concepts for analysis of near-threshold crack growth variability (paper #2) and multiple defect types (paper #3) in extreme value analysis. In recent papers #8 and #9 I have invented new probabilistic formats for calculating reliability respectively under LCF and HCF, areas where there is a lack of methods for dealing with the design uncertainties;
- **structural integrity assessment of railway components:** I am a recognized world expert in this topic, where I pioneered full-scale fatigue analyses (paper #1), crack growth probabilistic models for axles (paper #2) that had been validated by full scale tests and companion specimens (papers #1 and #5). My researches have produced the only available corrosion-fatigue model for assessment of railway axles exposed to rainwater corrosion (paper #4). This activity deserved me to participate to a successful bid for the T728 Project by RRSB and it was the background for EU projects WOLAXIM and RAAI;
- **new test method for the growth rate/threshold of short cracks under RCF conditions:** I have been able to experimentally reproduce the co-planar growth of short cracks under shear in out-of-phase stress histories with a novel test method (a challenge since the times of my PhD at Kyushu University) and to measure the growth rate of short cracks under RCF conditions (papers #6 and #7). The experiments have supported the modification of Dang Van's criterion for analysis of complex parts (later papers);
- **new design fatigue concepts for AM materials:** the analysis of fatigue problems in terms of prospective propagation/threshold for an inhomogeneity or a flaw has been a key tool for understanding the fatigue properties of materials obtained by AM and to suggest new routes for assessment (paper #10), new computational methods (second patent in preparation) and new fundamental research (cooperation with ESA and MIDAF project) .

## Track-record

### Overview

Bibliometric indexes (Source: SCOPUS, 15th Aug. 2017): H-index = 18 and 1015 citations (w/o self-citations), this metrics does not include a paper published in 1999 on the journal *Extremes*, covered by SCOPUS only from 2004, with more than 80 citations). Papers in the last 10 years: H-index = 12 with 525 citations (w/o self citations).



**Fig. 1 - Trend of the citations in the last 10 years (source SCOPUS).**

### 10 representative publications as the main author

1. S. BERETTA, A. GHIDINI, F. LOMBARDO (2005). Fracture mechanics and scale effects in the fatigue of railway axles. *ENG. FRACTURE MECHANICS*, vol. 72; p. 195-208.

I have had the idea of launching an activity on fatigue of railway axles: this paper summarizes the results obtained in the first 5 years of research that I conceived and directed. F. Lombardo was my PhD student.

2. S. BERETTA, M. CARBONI (2006). Experiments and stochastic model for propagation lifetime of railway axles. *ENG. FRACTURE MECHANICS*, vol. 73; p. 2627-2641.

I coordinated the research and I had the idea of the RV approach. I took care of the statistical analysis of crack growth data, the Montecarlo simulation with RV variables and I wrote the paper.

3. S. BERETTA, C.W. ANDERSON, Y. MURAKAMI (2006). Extreme value models for the assessment of steels containing multiple types of inclusion. *ACTA MATERIALIA*, vol. 54; p. 2277-2289.

This paper condenses the new ideas emerged during the activity of ESIS TC20: here I wrote the paper, invented one of the models, took care of the statistical properties of the models and their implementation.

4. S. BERETTA, M. CARBONI, G. FIORE, A. LO CONTE (2010) Corrosion-fatigue of A1N railway axle steel exposed to rainwater. *INT. JOURNAL OF FATIGUE*, Vol. 32, Pages: 952-961.

I coordinated the research and elaborated the crack growth data under corrosion fatigue in a new model.

This paper deserved me to take part in the T728 Project by RSSB (together with Deltarail and TWI)

5. S. BERETTA, M. CARBONI (2011). Var. amplitude fatigue crack growth in a mild steel for railway axles: Experiments and predictive models *ENG. FRACTURE MECHANICS*, Vol. 78, pp. 848- 862.

The concepts of papers #1-#2 have been extended to the adoption of a new SE(T) spec for crack growth experiments and comparison with full-scale data under VA: I conceived and designed the specs, organized the research and wrote the paper.

6. S. BERETTA, S. FOLETTI, K. VALIULLIN (2011). Fatigue strength for small shallow defects/cracks in torsion *INT. JOURNAL OF FATIGUE*, Vol. 33, (pp. 287- 299).

7. S. BERETTA, FOLETTI S., VALIULLIN K. (2010) Fatigue crack propagation and threshold for shallow micro-cracks under out-of-phase multiaxial loading in a gear steel. *ENG. FRACTURE MECHANICS*, Vol. 77, Pages: 1835-1848.

Papers #6-#7 show that microcracks can propagate under stable Mode II and III under RCF conditions: I invented the test method, led the research and taken care of the papers.

8. S. BERETTA, S. FOLETTI, E. RUSCONI, A. RIVA, D. SOCIE (2016). A log-normal format for failure probability under LCF: Concept, validation and definition of design curve. *INT. JOURNAL OF FATIGUE*, vol. 82, p. 2-11

9. S. BERETTA S, D. REGAZZI (2016). Probabilistic fatigue assessment for railway axles and derivation of a simple format for damage calculations. *INT. JOURNAL OF FATIGUE*, vol. 86, p. 13-23

Papers #8-#9 show new concepts for the fatigue assessment of components, inventing new probabilistic formats and simple methods for design. I led the researches and had the ideas of the methods here adopted.

10. S. BERETTA, S. ROMANO (2017) A comparison of fatigue strength sensitivity to defects for materials manufactured by AM or traditional processes. *INT. JOURNAL OF FATIGUE*, vol. 94, pp. 178-191.

In this paper I have shown that the significant scatter of thresholds for AM materials, that needs to be considered for engineering assessment, is related to the presence of defects. This paper marks also the start of the liaison with ESA (European Space Agency). S. Romano is my PhD student.

## Monographs

S. BERETTA (2009) - *Affidabilità delle Costruzioni Meccaniche*, Springer.

## Patents

Patent " Arm made of composite material and respective production method": patent registered by CIFA in EU (patent: EP 2 248 755 B1) and in US (patent US2010/0282701A1) since 2010. The inventors are: myself, my junior colleague A. Bernasconi and two designers at CIFA.

Software copyright " A Finite Element subroutine for the failure probability of a component containing defects" (application in progress). I invented the concept for incorporating into FE analysis a calculation of fatigue failure probability for a material/component containing defects based on *extreme value* analysis.

## Recognitions and Honours

I have been invited to several scientific events in the last 10 years, the most significant recognitions are:

2007 – Plenary lecture at Int. Conf. on Multiaxial Fatigue and Fracture (ICMFF8), Sheffield (UK);

2009 - Best Paper Award at International Conference on Fracture -ICF12, Ottawa (Can);

2010 – Conferred on *ESIS Fellowship*, Dresden;

2010 - Invited speaker at Int. Conf. on Multiaxial Fatigue and Fracture (ICMFF9), Parma (Italy);

2011 - Guest Editor of a Special Issue of *Engng. Fracture Mechanics* with Prof. U. Zerbst.;

2012 – Keynote lecture at Crack Path 2012 Conference, Gaeta (Italy);

2013 - Plenary lecture at Mat. Structure & Micromech. of Fracture 7 (MSMF7) Conf., Brno (Czech Rep.);

2014 - Keynote lecture at Fatigue Damage and Material Defects-II (FDMD-II) Conference (Paris)

2014 - Plenary Lecture at Int. Coll. on Mechanical Fatigue of Metals - 17 (ICMMF-17) (Verbania, Italy)

2015 - Plenary Lecture at Variable Amplitude Loading-2015 (VAL2015) Conf., Prague (Czech Rep.)

2016 - Guest Editor of a Special Issue of *Int. J. Fatigue*.

2016 - Invited lecture at Mat. Structure & Micromech. of Fracture 8 (MSMF8) Conf., Brno (Czech Rep.).

2017 - Guest Editor of a Special Issue of *Procedia Structural Integrity*.

## Major contribution to early careers

Dr. M. Carboni worked with me since his Phd and last year he has reached the position of Associate Professor at my Department. Since 2008, I supervised the activity of three researchers (A. Bernasconi, M. Filippini and S. Foletti), who are now Associate Professors. Dr. M. Madia, after PhD with me, became researcher in my group, at PoliMi and he has now a permanent position at BAM (Berlin).

Two of my PhD students (L. Patriarca and S. Rabbolini) were conferred of Prizes at IGF and AIAS National Conferences. Dr. L. Patriarca, after a PostDoc at UIUC, is now Researcher at Politecnico di Milano.

## Research leadership

I have the experience of leading a research group and cooperative research projects: in particular I wrote ESIS P11-02 that was incorporated into ASTM E2283-03. I organized and managed the round-robin of ESIS TC20. I also organized and managed, through ESIS TC24, together with U. Zerbst, a benchmark of SIF calculations for railway axles. I have been successfully managing ESIS-TC24 since 2010.

My research activity in the last 10 years has been supported mainly by a series of industrial projects, whose I have been the promoter and the research leader. The industrial cooperation has been always inspirational in my research, for addressing relevant topics for future applications (extreme value analysis of defects; crack propagation driven by shear in RCF, structural integrity of railway components, qualification of components obtained with new processes).

Milan, September 2017

In faith,



Prof. Stefano Beretta