



CURRICULUM VITAE (CVA)

IMPORTANT – The Curriculum Vitae cannot exceed 4 pages. Instructions to fill this document are available in the website.

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|---|---------------------|----------------|-----------|
| Part A. PERSONAL INFORMATION | | CV date | 15/1/2022 |
| First name | María Covadonga | | |
| Family name | Betegón | | |
| Gender (*) | Female | Birth date: | |
| Social Security, Passport, ID number | | | |
| e-mail | cova@uniovi.es | URL Web | |
| Open Research and Contributor ID (ORCID)(*) | 0000-0002-1218-5423 | | |

(*) Mandatory

A.1. Current position

| | | | |
|-------------------|--|----------------|--|
| Position | Professor | | |
| Initial date | 1987 | | |
| Institution | University of Oviedo | | |
| Department/Center | Construcción e Ingeniería de Fabricación/ Escuela Politécnica de Ingeniería de Gijón | | |
| Country | Spain | Teleph. number | |
| Key words | Solid mechanics, fracture, numerical modelling, structural integrity | | |

A.2. Previous positions (research activity interruptions, art. 45.2.c))

| Period | Position/Institution/Country/Interruption cause |
|-----------|---|
| xxxx-xxxx | |
| yyyy-yyyy | |

A.3. Education

| PhD, Licensed, Graduate | University/Country | Year |
|-------------------------|------------------------------|------|
| Industrial Engineer | University of Oviedo / Spain | 1987 |
| Ph.D. in Engineering | University of Oviedo / Spain | 1990 |

Part B. CV SUMMARY (max. 5000 characters, including spaces)

My research career began as a research fellow at the University of Oviedo, where I later became a professor in the area of Mechanics of Continuous Media and Theory of Structures. Since then and until now I have participated in more than 30 R&D competitive projects and in more than 50 transfer contracts, With an h-index=20, I have published more than 40 scientific articles in indexed journals, and I have participated in more than 100 scientific conferences.

My scientific career has been based on the development of physical models for the mechanical behavior of different materials, and the relationships between the local fields (stress and strains) and the macroscopic measures of resistance (strength, toughness). Pioneeringly, I

have studied the effect of the geometry of the specimen in its toughness, establishing a second parameter to describe fracture conditions. I have shown that the toughness of some structures is higher than the one obtained from the normalized test specimens, opening the door to raise the limit load of the structures, and modifying the standards for design of pressure vessels. Also, I have worked on models of cleavage, ductile fracture, fatigue, delamination, adhesion, etc, with special attention to the parameters on the basis of which the models are established, and to the experimental methods necessary to obtain these values. In the last years, I have focused on the study of hydrogen embrittlement phenomena in high strength steels, incorporating in the corresponding micromechanical models of hydrogen diffusion, fracture and fatigue the effect of plastic deformation gradients. I have implemented the material degradation bias cohesive elements and phase field methods, in such a way that the fracture of the material is described as a complete process, with different phases, and not as a series of isolated events. I have also been working on the fracture of rock-like materials, developing micromechanical models that allow to describe quantitatively their fracture conditions.

The knowledge acquired has allowed me to collaborate with multiple companies in the solution of technical problems of design of complex structures and structural integrity. In this sense, I have participated in more than 50 contracts, addressing from all kinds of structural problems to biomechanical studies of hip and cervical prostheses, or the detailed study of the transition zone in large coke reactors. As a result of these transfer activities, more than 1.5 million euros have been obtained, which have been mainly devoted to the training of young researchers and the acquisition of scientific equipment within my working group.

I have been visiting professor at the University of Glasgow (UK), and Visiting Research Fellow at the Massachusetts Institute of Technology. I have conducted research stays, in addition, at the Universities of El Salvador and California Santa Barbara. I have supervised 7 doctoral theses, and some of the doctoral students have developed their careers in industry and others have pursued academic careers. One of them, Emilio Martínez-Pañeda, is a professor at Imperial College London, and we have a regular and fruitful scientific relationship.

From 2008 to 2016, I held various management positions at the University of Oviedo, including Vice-Rector for Academic Planning, Internationalization and Postgraduate Studies and President of the Doctoral Commission of the University. I have visited on behalf of the University of Oviedo, numerous universities around the world and formalized student and researcher exchange agreements with them. I have also been a member of the Internationalization Sectorial of the CRUE.

I am the coordinator of the SIMUMECAMAT consolidated research group (www.simumecamat.com), and a member of the Instituto Universitario de Tecnología Industrial de Asturias (www.iuta.es), which has more than 150 researchers. I am a regular reviewer of research projects (ANEP and regional agencies) and JCR scientific journals.

In 2018 I was appointed member of the Board of Directors of Duro Felguera S.A., an engineering company specializing in executing turnkey projects for the energy, industrial and Oil & Gas sectors. For the last two years, I have been President of the Spanish Commission for Evaluation of the Research Activity (field 6.1).

Finally, I have been granted five Oficial Research Periods, the last one ending in 2021.

Part C. RELEVANT MERITS (sorted by typology)

C.1. Publications (10 more relevant in the last 10 years)

A. Islas, A. Rodríguez-Fernandez, C. Betegón, E. Martínez-Pañeda, A. Pandal: CFD simulations of turbulent dust dispersion in the 20 L vessel using OpenFOAM. Power Technology 117033 (2021). <https://doi.org/10.1016/j.powtec.2021.117033>

Y. Navidtehrani, C. Betegón, E. Martínez-Pañeda: A unified Abaqus implementation of the phase field fracture method using only a user material subroutine. Materials; 14(8), 1913 (2021). <https://doi.org/10.3390/ma14081913>

R. Fernández-Sousa, C. Betegón, E. Martínez-Pañeda: Analysis of the influence of microstructural traps on hydrogen assisted fatigue. Acta Materialia 199:253-263 (2020). DOI: 10.1016/j.actamat.2020.08.030

E. Martínez-Pañeda, S. Fuentes-Alonso, C. Betegón: Gradient-enhanced statistical analysis of cleavage fracture. European Journal of Mechanics - A/Solids 77: 103785 (2019). DOI: 10.1016/j.euromechsol.2019.05.002

E. Martínez-Pañeda, S. del Busto, C. Betegón: Non-local plasticity effects on notch fracture mechanics. Theoretical and Applied Fracture Mechanics 92:276-287 (2017). DOI: 10.1016/j.tafmec.2017.09.007

S. del Busto, C. Betegón, E. Martínez-Pañeda: A cohesive zone framework for environmentally assisted fatigue. Engineering Fracture Mechanics 185:210-226 (2017) DOI:10.1016/j.engfracmech.2017.05.021

E. Martínez Pañeda, S. del Busto, C. F. Niordson, C. Betegón: Strain gradient plasticity modeling of hydrogen diffusion to the crack tip. International Journal of Hydrogen Energy 41(24):10265–10274 (2016) DOI:10.1016/j.ijhydene.2016.05.014

E. Martínez-Pañeda, C. Betegón: Modeling damage and fracture within strain-gradient plasticity. International Journal of Solids and Structures 59:208-215 (2016) DOI:10.1016/j.ijsolstr.2015.02.010

C. Rodríguez, F.J. Belzunce, C. Betegón, L. Goyos, L.A. Díaz, R. Torrecillas: Nanostructured Al–ZrAl₃ materials consolidated via spark plasma sintering: Evaluation of their mechanical properties. Journal of Alloys and Compounds 550:402-405 (2013) DOI:10.1016/j.jallcom.2012.10.143

E. Cárdenas, F.J. Belzunce, C. Rodríguez, I. Peñuelas, C. Betegón: Application of the small punch test to determine the fracture toughness of metallic materials. Fatigue & Fracture of Engineering Materials & Structures 35(5):441-450 (2012) DOI:10.1111/j.1460-2695.2011.01635.x

C.2. Congress

S. Del Busto, C. Betegón, E. Martínez-Pañeda. Predictive modelling of environmentally assisted fatigue. 20th International Colloquium on Mechanical Fatigue of Metals. Wroclaw (Polonia) [online], September 2021

Y. Navidtehrani, C. Betegón, E. Martínez-Pañeda. On strain energy splits and fracture driving forces in phase field fracture modelling. International Conference on Computational Plasticity. Barcelona. 2021

S. Del Busto, C. Betegón, E. Martínez-Pañeda. Predictive modelling of hydrogen-assisted fatigue crack growth. 15th International Conference on Advanced Computational Engineering and Experimenting. Malta, 2021. Invited talk.

S. Del Busto, E. Martínez-Pañeda, C. Betegón. The role of strain gradients on notch fracture mechanics. 2nd International Symposium Notch Mechanics. Madrid (Spain) [hybrid], 2021

C. Quintana, C. Rodríguez, C. Betegón, G. Álvarez, A. Maestro. Caracterización mecánica y modelo constitutivo del hueso trabecular porcino. GEF. 2020

C. Betegón, E. Martínez-Pañeda. A mechanism-based framework for fracture and damage in metallic materials. Plasticity, Damage and Fracture Conference. Puerto Rico. 2018

C. Betegón, S. del Busto, E. Martínez-Pañeda. Modelo de zona cohesiva para el estudio de la fatiga asistida por el ambiente. GEF. Málaga. 2018

S.del Busto, C. Betegón, E. Martínez Pañeda. Mechanistic-based modeling of fatigue in notched specimens. International Symposium on Notch Fracture (ISNF). Santander. 2017

C. Betegón, S. del Busto, E. Martínez-Pañeda. Mechanism-based hydrogen embrittlement assessment. XIV International Conference on Computational Plasticity. Barcelona. 2017

S. del Busto, E. Martínez-Pañeda, C.F. Niordson, C. Betegón. Numerical analysis of hydrogen transport ahead of the crack tip: the role of strain gradients. XIV National Congress on Materials. Gijón (Spain), June 2016

C.3. Research projects in the last 10 years

Ayudas a organismos públicos de investigación para grupos de investigación de organismos del Principado de Asturias en el período 2021-2023 – SIMUMECAMAT. Plan Regional de Investigación de Asturias. 2021-2023. 224.400 €. Investigadora principal

Micromechanics models for rock fracture: towards energy-efficient excavation (MCIU-19-PGC2018-099695-B-I00). Spanish Government - National Plan for Scientific Research. 2019-2022. 240.000€. Investigadora principal

Nuevos aceros para impedir la fragilización por hidrógeno. IUTA (Instituto Universitario de tecnología de Asturias). 2018-2021. 20.000 €. Investigadora principal

Ayudas a organismos públicos de investigación para apoyar la actividad que desarrollen sus grupos de investigación en el Principado de Asturias en el período 2018-2020 - SIMUMECAMAT. Plan Regional de Investigación de Asturias. 2018-2021 182.534. Investigadora

Hydrogen effect on fatigue and fracture toughness of medium and high strength steels used in the transport and storage of pressurized hydrogen. Plan Nacional de Investigación. 2015-2018. 140.000 €. Investigadora

Evaluation of the structural integrity of pipeline steels and their welded joints with acid gas presence. Spanish National Funding (DGICYT). 2012-2015. 70.248 €. Investigadora

Application of punch testing methodology to the evaluation of the structural integrity of gas pipeline steels. Spanish Government - National Plan for Scientific Research. 2009-2011. 179.080€. Investigadora principal.

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