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ISISE HIGHLIGHTS



Luís Simões da Silva, full professor at the Faculty of Science and Technology of the University of Coimbra (FCTUC), received a Honoris Causa Doctorate from the prestigious University of Liège in Belgium on 24 March. Under the proposal of the Faculty of Applied Sciences, the award of the degree to the professor of the faculty of the Civil Engineering Department of FCTUC “recognizes

the quality of his scientific work”. The cooperation of Luis Simões da Silva with the University of Liège began in 1993 in the framework of the project COST-C1, maintaining up to the present with several European projects in the field of steel and composite construction.



The content and opinions expressed within the Newsletter are those of the researchers involved and are not necessarily shared by the Directors of ISISE



R&D COMPLETED PROJECTS

> PUREST – Promotion of new Eurocode rules for structural stainless steels.

ISISE Principal Investigator: *Luís Simões da Silva*
Budget: Global: 368.171,28€ / ISISE-UC: 60.839,25€
ID: RFCS-02-2015-709600

Funding Entity: EU

Principal Contractor: SCI, London

Duration: From 01/07/2016 to 31/12/2017

Summary: The objectives of the PUREST project were to disseminate new design guidance for structural stainless steel which has been developed over the last 10-15 years. The following activities were carried out:

- i) Publication of the Fourth Edition of the Design Manual for Structural Stainless Steel,
- ii) Translating the Design Manual from English into 9 languages,
- iii) Developing design software and apps in accordance with the stainless Eurocode rules,
- iv) National seminars and recorded webinars,
- v) Developing a collection of teaching resources aimed at engineering students,
- vi) Articles in national engineering magazines.

The Design Manual for Structural Stainless Steel was updated to include the following:

- i) Amendment to EN 1993-1-4 (published in 2015);

- ii) Ferritic stainless steels,
- iii) Correction to flexural buckling curves,
- iv) Design information from other RFCS research projects, and
- v) Data from revised European standards and new sources of information, including additional design information based on work from Universities.



ISISE was involved in all the previous tasks, being responsible for the development of the Eurocode 3 stainless steel online design software and apps for iOS and Android platforms (ECCS e-store).



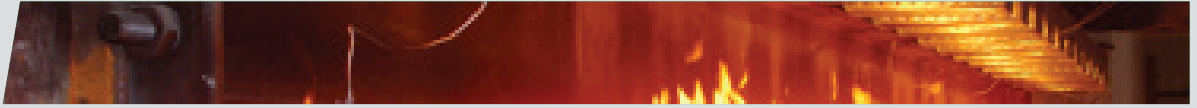
R&D STARTED PROJECTS

> NVTrail – Ruído e vibrações induzidas por tráfego ferroviário em túneis: uma abordagem integrada

ISISE Principal Investigator: *Luis Godinho*
Budget: Global: 239.906,95€ / ISISE-UC: 58.449,16€
ID: POCI-01-0145-FEDER-029577
Funding Entity: COMPETE2020 / FCT
Principal Contractor: University of Porto
Duration: From 01/06/2018 to 31/05/2021

> Fire_Improv_ColdFSteel – Innovative Constructive Solutions and Fire Design Models for Cold-Formed Steel Members of Enhanced Fire Behaviour

ISISE Principal Investigator: *Luís Miguel S. Lalm*
Budget: Global: 239.000,59€ / ISISE-UC: 227.445,91€
ID: POCI-01-0145-FEDER-031435
Funding Entity: P2020 & FCT
Principal Contractor: University of Coimbra
Duration: From 26/07/2018 to 25/07/2021



➤ **NanoFire – Thermal and mechanical behavior of Nano Cements and their application in Steel Construction as Fire Protection**

ISISE Principal Investigator: Aldina Santiago
Budget: Global: 237.972,78€ / ISISE-UC: 237.972,78€
ID: POCI-01-0145-FEDER-031850
Funding Entity: COMPETE2020 / FCT
Principal Contractor: University of Coimbra
Duration: From 26/07/2018 to 25/07/2021

➤ **Inno3DJoints – Innovative 3D joints for robust and economic hybrid tubular construction**

ISISE Principal Investigator: Luis Simões da Silva
Budget: Global: 185.647,56€ / ISISE-UC: 134.797,80€
ID: POCI-01-0145-FEDER-031834
Funding Entity: COMPETE2020 / FCT
Principal Contractor: University of Coimbra
Duration: From 26/07/2018 to 25/07/2021

➤ **CyclicSSRF – Cyclic behaviour of soils reinforced with steel fibers**

ISISE Principal Investigator: Paulo da Venda
Budget: Global: 239.905,04€ / ISISE-UC: 239.905,04€
ID: POCI-01-0145-FEDER-028382
Funding Entity: COMPETE2020 / FCT
Principal Contractor: University of Coimbra
Duration: From 26/07/2018 to 25/07/2021

➤ **INNOCFSConc – Innovative hybrid structural solution using cold-formed steel and lightweight concrete**

ISISE Principal Investigator: Hélder Craveiro
Budget: Global: 229.891,85€ / ISISE-UC: 229.891,85€
ID: POCI-01-0145-FEDER-031858
Funding Entity: COMPETE2020 / FCT
Principal Contractor: University of Coimbra
Duration: From 26/07/2018 to 25/07/2021

➤ **GF SEISMIC – Structural Glass Facades Under Seismic Action**

ISISE Principal Investigator: Sandra Jordão
Budget: Global: 225.977,12€ / ISISE-UC: 225.977,12€
ID: POCI-01-0145-FEDER-032539
Funding Entity: COMPETE2020 / FCT
Principal Contractor: University of Coimbra
Duration: From 26/07/2018 to 25/07/2021

➤ **Tyre4BuildInsul – Rubber tire recycled bonded with resins for insulation systems of energy-efficient buildings**

ISISE Principal Investigator: Paulo Santos
Budget: Global: 225.752,12€ / ISISE-UC: 225.752,12€
ID: POCI-01-0145-FEDER-032061
Funding Entity: COMPETE2020 / FCT
Principal Contractor: University of Coimbra
Duration: From 26/07/2018 to 25/07/2021

➤ **Adhesive Steel – Generalization of the use of structural adhesives in metallic bridges**

ISISE Principal Investigator: João Pedro Martins
Budget: Global: 222.573,36€ / ISISE-UC: 155.623,61€
ID: POCI-01-0145-FEDER-031545
Funding Entity: COMPETE2020 / FCT
Principal Contractor: University of Coimbra
Duration: From 26/07/2018 to 25/07/2021

➤ **Friction 4.0 – Modeling and Control of Heat Generated by Friction**

ISISE Principal Investigator: Dulce Rodrigues
Budget: Global: 230.235,11€ / ISISE-UC: 230.235,11€
ID: POCI-01-0145-FEDER-032089
Funding Entity: COMPETE2020 / FCT
Principal Contractor: University of Coimbra
Duration: From 26/07/2018 to 25/07/2021





> **VIPIB – Prediction and mitigation of vibrations in buildings induced by pile driving: an integrated methodology**

ISISE Principal Investigator: Luís Godinho
Budget: Global: 239.496€ / ISISE-UC: 49.950€
ID: POCI-01-0145-FEDER-029577
Funding Entity: COMPETE2020 / FCT
Principal Contractor: University of Porto
Duration: From 26/07/2018 to 25/07/2021



> **SPAFLAMIS – FRP-based innovative technique with improved fire behavior for the simultaneous flexural-shear/punching strengthening of reinforced concrete elements**

ISISE Principal Investigator: Salvador Dias
Budget: Global: 239.923,46€ / ISISE-UM: 216.173,46€ / ISISE-UC: 23.750,00€
ID: POCI-01-0145-FEDER-030956
Funding Entity: POCI and FCT
Principal Contractor: University of Minho
Duration: From 01/06/2018 to 27/11/2020
Partners: University of Coimbra

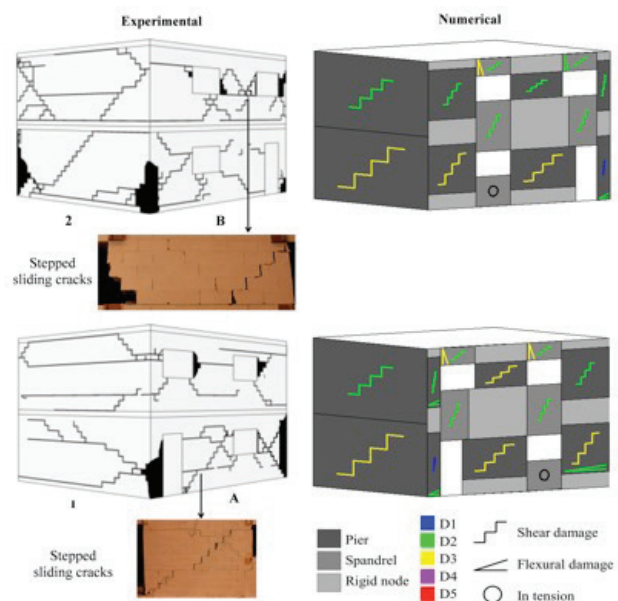
COMPLETED PHD THESES

> **Analytical and empirical seismic fragility analysis of irregular URM buildings with box behaviour**

Author: Hamed Azzizi Bondarabadi
Supervisors: Paulo Lourenço; Nuno Mendes
Date: March 26, 2018

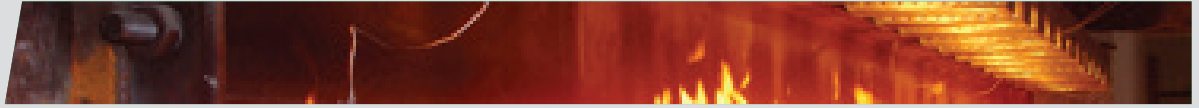
Summary: The thesis aims to develop a methodology to perform analytical seismic fragility analysis of typical unreinforced masonry (URM) buildings with box behavior and rigid diaphragms. To this end, first, the ability of the TREMURI software to reproduce the nonlinear dynamic response of regular and irregular URM buildings was validated with respect to results of shake table tests. Then, the validity of the extended N2 method to obtain reliable pushover-based demands considering higher mode effects in both plan and elevation was confirmed, proposing required changes for application of the method to URM buildings and applying the method to three case studies. Using the analytical tool validated before, the next phase of this study deals with the development of an analytical and empirical method for fragility analysis of typical masonry schools in Iran. A comparison was also made between the developed methods, from which the analytical approach was validated and the empirical one was calibrated.

interests include advanced numerical analysis of masonry structures, assessment and mitigation of the seismic vulnerability of masonry buildings, including the in-plane and out-of-plane response and experimental evaluation of the structural behavior of earthen constructions.



Comparison between numerical and experimental (Avila Velez, 2014) damage pattern for the symmetric concrete block masonry model.

CV: **Hamed Azizi Bondarabadi** obtained the PhD degree in Civil Engineering by the University of Minho in 2018. His research



> Macro-Element Nonlinear Dynamic Analysis for the assessment of Seismic Vulnerability of Masonry Structures

Author: César Javier Chácará Espinoza

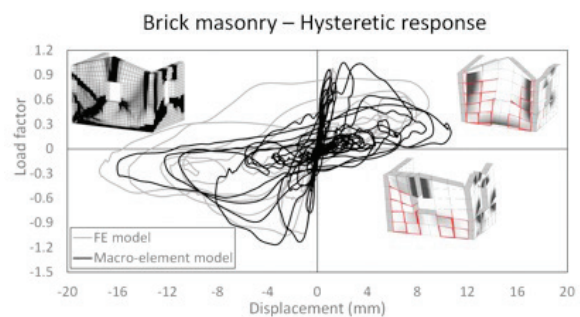
Supervisors: Paulo Lourenço; Ivo Caliò

Date: April 27, 2018

Summary: This work was devoted to the upgrade of a discrete macro-element modelling approach into the dynamic field aiming at assessing the seismic response of unreinforced masonry constructions. This work involved the definition of hysteretic models for the simulation of the cyclic response of these structures and the formulation of a mass matrix in accordance with the mechanical scheme of this modelling approach. The validation of these features was conducted considering three case studies in which the dynamic response obtained with proposed approach was compared to analytical and numerical results. The out-of-plane response of two masonry structures was investigated by FE and macro-element models by the application of nonlinear static and dynamic analyses. The macro-element models were capable of reasonably replicating the response of sophisticated models with a reduced computational cost.

The seismic vulnerability of one structure was assessed by the derivation of analytical fragility curves.

CV: César Javier Chácará Espinoza graduated in Civil Engineering by the Pontificia Universidad Católica del Perú (PUCP), and obtained the degree of PhD in Civil Engineering from the University of Minho, Portugal in 2018. He currently belongs to the research group Heritage & Engineering at PUCP. His research is focused on the assessment of the seismic behaviour and vulnerability of masonry structures.



Comparison of the dynamic response of the brick masonry structure between FE and macro-element models

> Long-term durability of bond in FRP-masonry components

Author: Seyed Hamid Maljaee

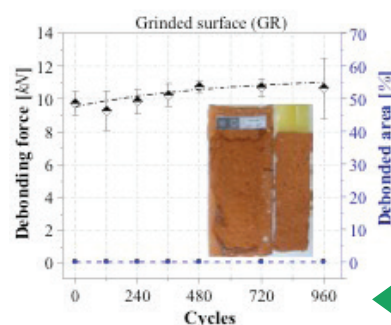
Supervisors: Paulo B. Lourenço; Bahman Ghiassi

Date: December 18, 2017

Summary: The thesis was aimed at assessment of the long-term performance and durability of bond in FRP strengthened masonry composites. The main objectives were: i) assessment of bond degradation mechanisms in two recognized destructive environmental conditions through a set of accelerated ageing tests, i.e. water immersion and hygrothermal exposure, ii) development of suitable decay models for strengthening masonry materials and bond behavior under different environmental conditions, iii) assessment of thermal behavior of epoxy resin at the interface layer to better understand the durability performance of the bond and its degradation mechanisms, iv) investigation of the effect of surface treatment on FRP-to-brick bond durability and v) investigation of the time-dependent response of epoxy resins and FRP-to-brick bond under sustained loads. The bricks' surface treatment (GR-specimens) led to

noticeable improvement of bond durability. Furthermore, while ORG-specimens (without treatment) delaminated after a short time under sustained load, GR-specimens showed no delamination during the test time.

CV: Hamid Maljaee graduated in MSc Civil Engineering in 2012 from University of Teesside (UK) and holds his PhD degree in 2017 from University of Minho (Portugal). He is the author of 12 published papers (including journal and conference papers) in the fields of strengthening of masonry elements using EBR/NSM-FRP/TRM systems and degradation mechanisms in composites and polymers.



Bond degradation due to hygrothermal exposure



> **Stability Design of Steel Columns, Beams and Beam-Columns: Behaviour, General Formulation and Reliability**

Author: Trayana Tankova

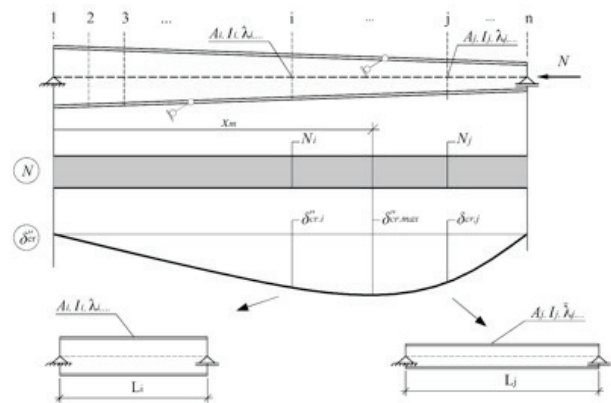
Supervisors: Luís Simões da Silva e Liliana Marques

Date: June 19, 2018

Summary: In this thesis, a novel general formulation for stability design of steel columns, beams and beam-columns with variable geometry, loads and supports covering any buckling mode was developed. The verification is based on the buckling mode as shape of the initial imperfection with an amplitude previously calibrated for the standard prismatic simply-supported columns and beams in Eurocode 3. This general formulation is transparent and consistent with the Eurocode 3-1-1 design rules. It avoids the calibration of additional factors because it is applied as an interaction equation and the first and second order contributions to the longitudinal stress utilization are added for each cross-section along the member length. In order to ensure its reliability, systematic safety assessment of the Eurocode 3-1-1 stability design rules for prismatic columns, beams

and beam-columns were assessed using statistical data which reflects the steel production nowadays.

CV: **Trayana** holds MSc from UACEG, Sofia (2011). She worked as a Structural Engineer at design office after her graduation for two years. Later, she graduated with distinction the master course SUSCOS_M at the University of Coimbra and CVUT Prague (2014). She continued as a researcher at the University of Coimbra and was awarded a PhD in Steel and Composite Construction in 2018



ISISE TECHNOLOGIES

> **Long-Baseline Neutrino Facility (LBNF) steel joints**

ISISE Investigators: Luís Simões da Silva, Hélder D. Craveiro, Rui D. Simões

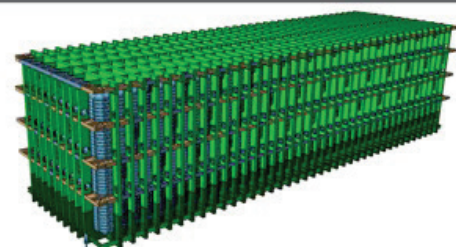
Partners: CERN: European Organization for Nuclear Research

Budget: 103287,00 €

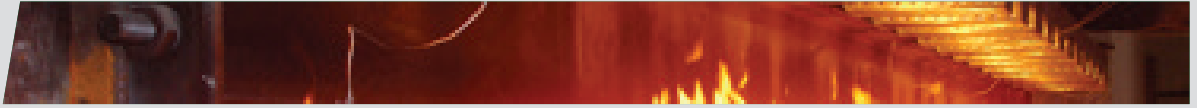
Duration: July 7, 2017 to October 30, 2018

Summary: The physics community is developing a dual-site experiment for neutrino science and proton decay, designated the Deep Underground Neutrino Facility (DUNE), hosted at Fermilab in Batavia, Illinois, USA (Figure 1). To conduct those experiments a new facility will be built, the Long-Baseline Neutrino Facility (LBNF). This facility will comprise the world's highest intensity neutrino beam and the necessary infrastructure to support the cryogenic far detectors, installed deep underground at the Sanford research facilities. The

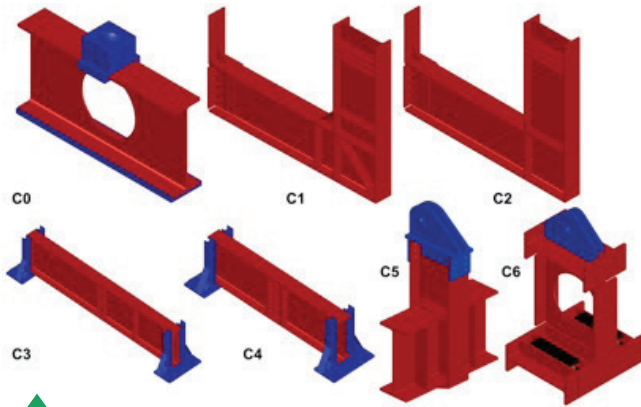
University of Coimbra and ISISE research group was selected by CERN to conduct an experimental study on the steel joints to be used in this facility.



Schematics on the experiment and LBNF facility



The objective of the research work is to perform full scale tests on very large specifically tailored bolted and welded steel joints between HLM 1100 profiles in steel S 460 (Figure 2), validating experimentally the behaviour of the steel joints.



Representation of the test specimens

The UC was responsible for the development, design and fabrication of the experimental test

set-ups and also provide technical support to the CERN team in specific subjects related with the design of steel joints. Seven full scale tests will be conducted at the UC laboratory facilities. In Figure 3 the test set-ups specifically design for some of the LBNF steel joints is depicted. This set-up includes a hydraulic jack with capacity up to 6000 kN.



Schematic representation of the defined test set-up for the LBNF steel joints

EVENTS

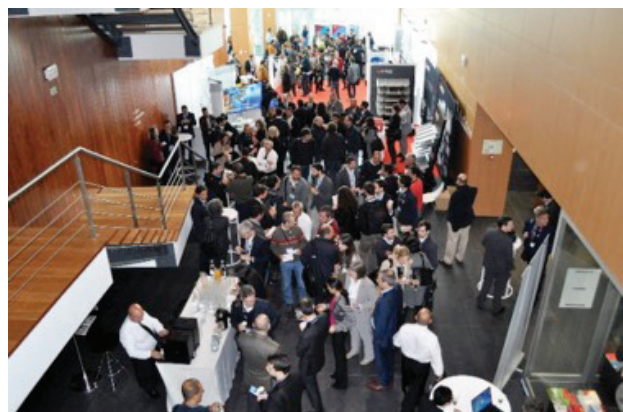
> XI Conference on Steel and Composite Construction

Venue: iParque - Coimbra

Date: November 23-24, 2017

Website: <https://www.cmm.pt/congresso11>

Summary: The biennial conference of CMM - Portuguese Steelwork Association, was held on 23 and 24 November 2017, at iParque - Coimbra. The XI Conference on Steel and Composite Construction highlighted the special theme "The New Generation of Eurocodes", sensitizing the technicians of the steel construction industry to the importance of standardization, highlighting the recent developments of the new versions of the Eurocodes. In this edition of the conference, two themes of extreme importance for the steel construction were also highlighted: architecture, where some awarded projects were presented with use of steel structure and the sea economy, emphasizing the importance it currently has in steel construction and presenting the growth potential that the sea economy can offer to the steel construction sector.





> **COST Action TU1406 Winter School Zell am See**

Venue: Zell am See, Salzburg, Austria

Date: December 18-21, 2017

Website: www.tu1406.eu/training/zellamsee

Summary: The aim of the COST TU1406 Winter School was to teach the most recent developments of COST Action TU1406 on performance indicators, performance goals and quality control plans, focusing on the findings of WG1, WG2 and WG3.

Participants were introduced to the tools and database developed within TU1406 which were applied to defined bridge structures in form of an interactive workshop.



> **COST Action TU1406 WG + MC Meeting & Workshop**

Venue: Wroclaw, Poland

Date: March 1-2, 2018

Website: www.tu1406.eu/meetings/wroclaw

Summary: The workshop of COST Action TU1406 was dedicated to the following topics:

- Bridge management systems;
- Methods and experiences of bridge Life-cycle Assessment;
- Quality control plans;
- Quality control measurements, techniques and methods.

During the 2-days workshop selected manuscripts were presented and discussed, followed by WG3, WG4 and WG5 meetings.





> **SMWeld Meeting**

Venue: Department of Civil Engineering, University of Coimbra

Date: May 2-4, 2018

Website: <http://www.smweld.com>

Summary: SMWeld project overall goal is to implement an international system for Higher Education and Practical Qualification of Welding Personnel. The project promotes student and staff mobility between South Mediterranean and European universities, the development of master programs in Welding and Joining, as well as the buildup of partnerships between universities, in Algeria and Tunisia, companies and other stakeholders.



> **Steel-concrete connections: post-installed connectors and composite connections (Hilti)**

Venue: Department of Civil Engineering, University of Coimbra

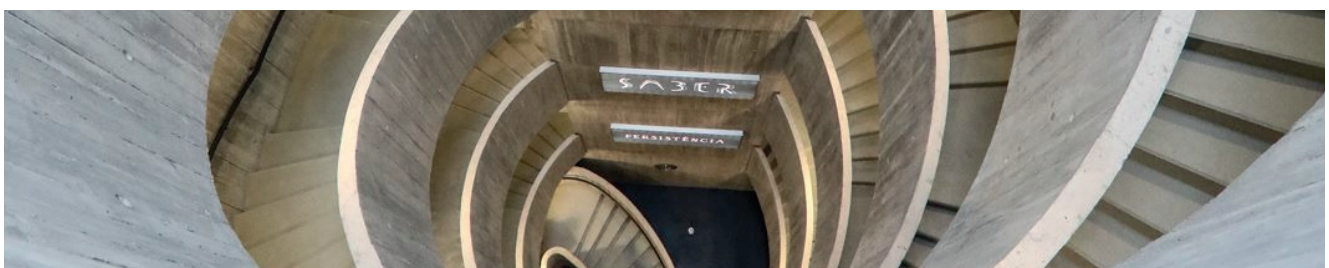
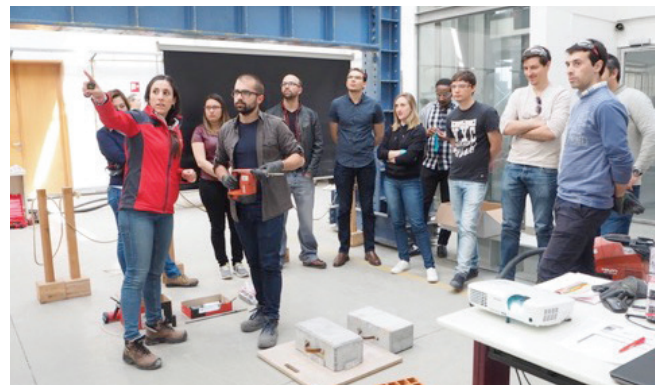
Date: May 4, 2018

Summary: In the scope of the course Building Design II and in collaboration with the Portuguese Association of Steel and Composite Construction (CMM) and the HILTI company, occurred at 4th of May the training course "Steel-concrete connections: post-installed connectors and composite connections". The course was organized in two parts:

PART A) lectured by the professors of the Building Design II: i) behavior of connectors for use in concrete; ii) design of column bases; iii) design of anchors for shear forces and iv) steel-concrete connections with post-installed connectors.

PART B) practical component of the application of post-installed connectors that was presented by the trainers of HILTI company.

The attendance comprised more than 30 professionals and students.





> **Workshop FREEDAM-FREE FROM DAMAge steel connections**

Venue: Coimbra, iParque

Date: May 10, 2018

Summary: FREEDAM project is aimed at the development of a new design strategy whose goal is the design of connections able to withstand without any damage the rotation demands due to seismic events, namely "Free From Damage Connections". Such innovative beam-to-column connections are equipped with friction dampers which are located at the bottom flange level of the connected beam to dissipate the earthquake input energy. The friction resistance is calibrated by acting on the number and diameter of bolts and their tightening torque governing the preloading. The flexural resistance results from the product between the damper friction resistance and the lever arm. The connections are conceived to exhibit wide and stable hysteresis loops without any damage to the connection steel plate elements.



> **Training Course on Design of Offshore Structures – 5th edition**

Venue: Department of Civil Engineering – University of Coimbra

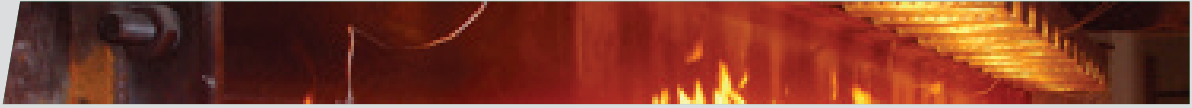
Date: May 15-18, 2018

Website: <https://www.cmm.pt>

Summary: The 5th edition of the course "Offshore Structure" promoted by University of Coimbra and CMM, intends to provide knowledge regarding the design of steel elements in offshore structures, through the identification of the main actions, description of steel material used in offshore structures, protection and corrosion of steel structures in maritime environment and of the most relevant features in sea operations.

This course aims at students of civil engineering, civil engineers, mechanical engineers and technicians connected to the area of steel construction.





> **Semana da Economia: “Digital Evolution in Construction and Cities”**

Venue: Forum Braga, Braga, Portugal

Date: May 25, 2018

Website: <https://www.investbraga.com/events/details.php?id=424>

Summary: The Institute for Bio-Sustainability (IB-S), the dstgroup and the Chair dst/IB-S: “Smart Systems for Construction” promoted last May 25th, at Forum Braga, the initiative “Digital Evolution in Construction and Cities” within the scope of the 3rd Braga’s Economy Week organized by InvestBraga. The event had the participation of the Ministers of Economy and Environment, namely, Manuel Caldeira Cabral and José Matos Fernandes, the Mayor of Braga, Ricardo Rio, and several national and international speakers lecturing about digital construction, industry 4.0, smart cities and circular economy.



> **Conserving the Bagan built heritage – NDT testing in the Loka-Hteik-Pan Temple**

Venue: Bagan, Myanmar

Date: May 21-25, 2018

Summary: A team of the SAHC International Masters Course, in collaboration with the Department of Archaeology and National Museum of Bagan (Myanmar) and the Carleton University (Canada), carried out dynamic identification and sonic tests in the Loka-Hteik-Pan Temple (Bagan). The results of the tests will be used for the calibration of a FEM model. Finally, the seismic performance of the Temple will be evaluated.



UPCOMING EVENTS

> **SynerCrete’18 – Interdisciplinary Approaches for Cement-based Materials and Structural Concrete: Synergising Expertise and Bridging Scales of Space and Time**

Venue: Funchal, Portugal

Date: October 24-26, 2018

Website: www.synercrete.com

> **Conference IABSE 2019**

Venue: Centro Cultural Vila Flor, Guimarães, Portugal

Date: March 27-29, 2019

Website: www.iabse.org/guimaraes2019





> **CMN2019 – Congress on Numerical Methods in Engineering**

Venue: Guimarães, Portugal

Date: July 1-3, 2019

Website: <http://cmn2019.pt/>

> **SHATiS'2019 – International Conference on Structural Health Assessment of Timber Structures**

Venue: Guimarães, Portugal

Date: September 25-27, 2019

Website: www.shatis19.pt

> **3rd ICITG 2019 – 3rd International Conference on Information Technology in Geo-Engineering**

Venue: Guimarães, Portugal

Date: September 29 to October 2, 2019

Website: www.3rd-icitg2019.civil.uminho.pt

> **CSS9 – 9th ECCS-AISC International Workshop on Connections**

Venue: Coimbra, Portugal

Date: June 2-4, 2020

MASTER COURSES

> **Master Course on Acoustic and Energy Efficiency for a Sustainable Construction**

Venue: Department of Civil Engineering, University of Minho

Website: <http://www.dec.uc.pt>

Application dates:

> 3rd call: 24th August until 5th September

> **Master Course in Building Reabilitação**

Venue: Department of Civil Engineering, University of Coimbra

Website: <http://www.dec.uc.pt>

Application dates:

> 3rd call: 24th August until 5th September

> **Advanced Masters in Structural Analysis of Monuments and Historical Constructions**

Venue: Department of Civil Engineering, University of Minho

Website: <http://www.msc-sahc.org>

Application dates:

> 3rd call: 15th June

PHD COURSES

> **Doctoral Program Steel and Composite Construction**

Venue: Department of Civil Engineering, University of Coimbra

Website: <http://www.dec.uc.pt>

Application dates:

> 3rd call: 24th August until 5th September

> **Doctoral Program in Civil Engineering**

Venue: Department of Civil Engineering, University of Minho

Website: <http://www.pdec.civil.uminho.pt>

Application dates:

> 2nd call: August, 28th until September, 3rd 2018

