1st Biennial ESIS-CSIC Conference on Structural Integrity BECCSI 2025

Book of Abstracts

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Proceedings of the 1st Biennial ESIS-CSIC Conference on Structural Integrity - BECCSI 2025

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PREFACE

Dear Colleagues, Dear Friends,

It is with great pleasure that we welcome you to our beautiful city of Belgrade (Serbia) for the 1st edition of the Biennial ESIS-CSIC Conference on Structural Integrity (BECCSI 2025). But first, a couple of words about the organisers of this international scientific event - the European Structural Integrity Society, the China Structural Integrity Consortium and the co-organiser, the Society for Structural Integrity and Life “Prof dr Stojan Sedmak”.

The China Structural Integrity Consortium (CSIC) is a non-profit academic organization committed to promoting academic exchanges, advancing scientific research, facilitating engineering applications, and disseminating knowledge specifically in the realm of structural integrity. Its origins can be traced back to 2002, spearheaded by a consortium of universities and research institutes that have historically participated in joint research focused on structural integrity, especially concerning the safety technology of pressure vessels and pipelines. In 2003, the inaugural International Fracture Mechanics (FM) Symposium took place in Shanghai. As the discipline and its application areas broadened, the FM series of conferences transitioned in 2010 to the International Symposium on Structural Integrity (ISSI), with member institutions rotating the responsibility of organization. In November 2012, following extensive discussions and consultations among the Materials Division, Pressure Vessel Division, and Failure Analysis Division of the Chinese Society of Mechanical Engineering, the decision was made to collaboratively establish the CSIC. The latest ISSI took place in Dongguan from November 5th to 8th, 2024.

The European Society for Structural Integrity (ESIS) is an esteemed international non-profit engineering scientific society. Its primary mission is to foster and enhance knowledge surrounding all facets of structural integrity and to disseminate that knowledge widely. The overarching goal is to elevate the safety and performance of structures and their components. The origins of the European Structural Integrity Society can be traced back to November 1978 during a summer school event in Darmstadt, Germany. Initially, it was known as the European Group on Fracture. From 1979 to 1988, several technical committees were established, with the Elasto-Plastic Fracture Mechanics committee being the first among them. The initial vision was to emulate the work of the ASTM committee in Europe. Dr. L.H. Larsson from the European Commission Joint Research Centre served as the inaugural president of the European Structural Integrity Society. Currently, ESIS comprises a total of 24 technical committees and national groups across all European countries. The present president of ESIS is Prof. Aleksandar Sedmak from the University of Belgrade in Serbia.

The Society for Structural Integrity and Life (Serbian Društvo za integritet i vek konstrukcija "Prof. Dr. Stojan Sedmak", or simply DIVK) is a non-governmental, non-profit society of experts engaged in the practical application of the theory of fracture mechanics. Founded in 2001, today the Society has more than 240 registered members and engages in a number of activities such as seminars, publications, cooperation with other societies, and more. The journal "Structural Integrity and Life" is published by DIVK.

The Society aims to master contemporary theoretical, numerical, and experimental methods for structural integrity assessment in order to apply them to ensure in-service safety and reliability and to extend their design life, enable the prevention of failures to minimize the risk of endangering human lives and polluting the environment, and improve the level of education and publishing in the field.

The editors of the Proceedings of the 1st Biennial ESIS-CSIC Conference on Structural Integrity - BECCSI 2025 (Book of Abstracts),

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  Additive manufacturing, current trends and future opportunities

- **Lixun Cai,** School of Mechanics and Aerospace Engineering, Southwest Jiaotong University, Chengdu, China

  Analytical Mechanical Theory and High-Throughput Indentation Instrument

- **Sabrina Vantadori,** Department of Engineering & Architecture, University of Parma, Italy

  Francesco Iacoviello, University of Cassino and Southern Lazio, Department of Civil and Mechanical Engineering, Italy

  From metals to nanomaterials: A comprehensive approach to fracture toughness assessment

- **Jacque Besson,** MinesParis PSL, Centre des Matériaux CNRS, France

  Simulation of ductile rupture: from micromechanics to structural failure

- **Wanlin Guo,** State Key Laboratory of Mechanics and Control for Mechanical Structures, Nanjing University of Aeronautics and Astronautics, Nanjing, China

  Three-dimensional fatigue fracture mechanics: Bridge the gap from laboratory to engineering Structures

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  How hydrogen damages Ni-based alloys at elevated temperatures

- **Miloš Đukić**, Universit of Belgrade, Faculty of Mechanical Engineering, Serbia

  Hydrogen embrittlement mechanisms in metals: New insights

- **Tong Liu**, School of Mechanical and Power Engineering, Shanghai China

  Nuclear fuel cladding degradation: Embrittlement visualization of Cr-Coated zircaloy

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COMPARATIVE EVALUATION OF EXPERIMENTAL AND PHASE-FIELD MODELING APPROACHES IN THE TENSILE RESPONSE OF S1100QL STEEL

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Abstract

Phase-field Damage Modeling (PFDM) has gained considerable attention as a robust framework for representing material degradation and failure. Its capacity to describe the progressive evolution of damage has led to increasing integration into finite element method (FEM) codes, establishing PFDM as a promising tool for structural assessment. In this study, an axisymmetric PFDM formulation is implemented and validated through comparison with experimental tensile tests on high-strength S1100QL steel specimens.

Cylindrical specimens were machined from the base material using CNC lathes to determine its tensile properties. The tensile tests were subsequently performed on a universal testing machine, ZWICK ROELL Z/100 (ZWICKROELL GmbH, Ulm, Germany) (Fig. 1a).

The critical-total strain-based PFDM implemented into the software PAK-DAM v25 is used for numerical analysis of tensile tests. For numerical simulation, an FE model was created using 2D axisymmetric finite elements. The simulation was performed using the large strain von Mises plasticity constitutive model and logarithmic strain measure. The created FE model consists of 970 elements and 1078 nodes. The FE model, boundary conditions, and loading of the specimen are given in Fig. 1b.

In Fig. 1c, a comparison of the stress-strain diagram for the numerical simulation and the experiment is given. The results show good agreement between the experiment and the numerical simulation results.

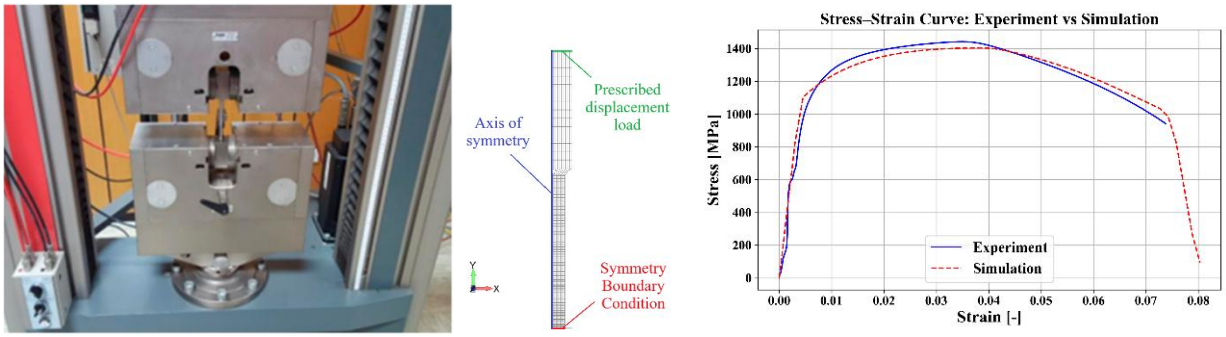

Figure 1. a) ZWICK ROELL Z/100 testing machine; b) FE Model with boundary conditions and loads; c) comparison of stress-strain diagram for experiment and numerical analysis

Keywords: Finite Element Method; Phase-Field Damage Model; S1100QL Steel; PAK-DAM

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