64th ESReDA Seminar On
Digital Maintenance in the Digital Twin Era.
May 30th – 31th, 2024,

The Digital Twin Week
University of Deusto, Bilbao (Spain)

Announcement and Call for Papers

64th ESReDA seminar within The Digital Twin Week. Bilbao May 29th-31st, 2024

The Digital Twin Week is an event jointly promoted by ESReDA and the University of Deusto, along with projects funded by the European Union, BUILDCHAIN and ENHANCE. In addition to the 64th ESReDA regular seminar, this event includes a Doctoral Workshop on digital twin techniques (Bilbao, May 29th-31st, 2024).

More information about the workshop at the end of this document.

Scope of the 64th ESReDA seminar

The study of the digital transformation in the context of industry and infrastructure is highly topical and interesting. One of the business areas where this transformation is expected to be most significant is maintenance. It is, therefore, important to analyze how maintenance can benefit from this transformation and how to do it: What are the new technologies and tools with the greatest potential impact on maintenance and why? How can this transformation process be mandated and realized? How will emerging asset management platforms, intelligent maintenance Apps, and digital twins technology impact companies?

The advent of new technologies has made the maintenance landscape more intricate, necessitating efficient management of vast information and predictive alarms within dynamic schedules. However, the complexity of optimizing the maintenance decision-making process often hampers the technology's impact on organizations. Consequently, conventional maintenance practices continue to be the norm, leading to a delay in embracing digitalization and hindering the expected return on investment for companies undergoing the digital transformation effort. Overcoming this resistance to change is paramount, especially with the emergence of advanced digitalization approaches like digital twins technology, which introduces a new dimension and a complex System of Systems (SoS) scenario.

Furthermore, the role of individuals in the context of maintenance digitalization of maintenance is critical. Embracing digital transformation offers an opportunity for human evolution, leveraging the expertise and experience of employees in the new digital environment. This, in turn, provides a competitive edge in driving innovation and technological progress.

The challenges become even more significant when considering the transformation of assets or systems with limited digitization. Such assets represent a considerable portion of those amenable to digitization today and often hold valuable knowledge about their degradation and maintenance, typically residing with the personnel responsible for their management. Capturing and transferring this expertise into digital twin systems or intelligent maintenance Apps becomes essential for fully unlocking the potential benefits of digital transformation in maintenance practices as digitalization continues to advance.

This seminar aims to bring together researchers, practitioners, and experts from various disciplines to share their insights and advancements in the realm of digital maintenance and its relationship with digital twins, complex systems, and human resources. The event intends to provide a vision of digital maintenance once the foundational technologies (AI, predictive analytics, digital twins, IoT, cloud/edge/fog computing, etc.) have reached a sufficient degree of maturity. This vision should facilitate drawing conclusions on the approaches needed to overcome current barriers that limit the full development of digital maintenance, particularly in assets and systems with a low level of digitization. During the seminar, participants will have the opportunity to share experiences in applying different technologies to improve maintenance, review the state of the art of these technologies, and evaluate their real impact on organizations and the evolution of their maintenance models..

Topics

We invite researchers and professionals to submit their original and high-quality papers related to the following topics (but not limited to):

1. Current Barriers in Implementing Technologies for Real Maintenance Evolution:

- Identification and analysis of challenges hindering the adoption of digital maintenance technologies.
- Barriers to integrating cutting-edge maintenance practices in traditional industrial environments.
- Case studies highlighting real-world experiences and lessons learned in overcoming barriers.
- Maintenance Modelling: Addressing the significance and challenges of creating comprehensive maintenance models for various assets, exploring approaches to predictive maintenance, failure analysis, and decision-making processes.

2. Advancements of Digital Twins in Complex Systems Generation:

- Digital twins and/or asset administration shell as fundamental components of complex systems in the Industry 4.0 era.
- Challenges and solutions in defining and treating assets within digital twins
- Applications of digital twins in predictive and prescriptive maintenance strategies.
- Integration of IoT, AI, and data analytics for enhancing digital twin capabilities.
- Digital twins and MBSE (Model Based System Engineering).
- Limitations and opportunities of digital twin technology
- Standardization approaches.

3. The Role of Human Resources in the Context of Digital Maintenance and Digital Twins:

- Skill gaps and training requirements for the workforce to embrace digital maintenance.
- Human-computer interaction and collaboration in the digital twin environment.
- Strategies for upskilling and reskilling the maintenance workforce for the digital era.

Domains

- OEM (Original Equipment Manufacturers)
- Power generation & supply
- Process industry
- Gas & Oil production, storage & transport
- ICT networks, data storage & servers

- Transport: rail, road, air and maritime
- Supply chain process
- Water supply, water treatment, and water works

Chairman of the Seminar

- Dr. Aitor Goti, Associate Professor in Department of Mechanical, Design and Industrial Management Maintenance, Universidad de Deusto

Technical Programme Committee (TPC) (To be confirmed and enriched)

Aitor Goti	SP	José López Domínguez	SP
Adolfo Crespo	SP	Diego López de Ipiña	SP
Juan Chiachio	SP	Diego Casado	SP
Manuel Chiachio	SP	John Andrews	UK
Antonio J. Sanchez	SP	Joaquín Ordieres	SP
Hermann G. Matthies	GER	Miguel Ortega	SP
Najm Habib	USA	Aitor Oyarbide	SP
Anna Kucerova	CZ	Elisabete Alberdi	SP
Andras Benczur	HU	Micaela Demichela	IT
Noémi Friedman	HU	Rasa Remenyte-Prescott	UK
Alberto Martinetti	NL	Antonio J. Guillén	SP
Cyp F.H. van Rijn	NL	Mohamed Eid	FR

Local Organization Committee (LOC)

For practical local information relative to the venue, please, contact: Aitor Goti (aitor.goti@deusto.es) with Antonio Guillén (ajguillen@us.es) and Mohamed Eid (eid.etudes@gmail.com) in Cc.

Relevant dates

- Submission of abstracts: January 20th, 2024
- Authors notification: February 10th , 2024
- Full papers or extended abstract: March 31th, 2024
- Dates of seminar: 30th - 31th May
- Dates of Doctoral Workshop   29th-31th May
- ESReDA project group's meetings: 29th May, 2024
- ESReDA Board of Directors meetings: 29th May, 2024
- ESReDA General Assembly: 30th May, 2024
- ESReDA Gala dinner: 30th May, 2024

Procedure to submit an abstract, paper and to register

Authors wishing to present a paper are invited to submit a short abstract (max. 400 words) and author' names online, before 20th Jaunary 2024. Extended abstracts are an alternative to full papers. An extended abstract should be at least one page in length, and it should include a list of most relevant references (5 or 6). Both extended abstracts and full papers will be published in the JRC technical report.

The full papers or extended abstracts should be submitted before March 31st 2024 and should address the following:
- Objectives;
- Relevance for the Seminar;
- Novelty;
- Data, Methods and findings
Proposals should be sent to Aitor Goti (aitor.goti@deusto.es) and Antonio Guillén (ajguillen@us.es)

Registration and Seminar Fee

A registration form and the practical information package will be made available on the ESReDA website. Fees, according to ESReDA's rules, are:

- Speakers   :   one speaker per accepted paper is exempted.
- ESReDA members   :   3 participants/member are taken in charge by the Seminar.
- Others   :   300€/participant
- Accompanied persons for Gala dinner: 30€/acc. person.

To be paid by bank transfer to ESReDA account:

Holder	:	ESReDA
Bank	:	BNP Paribas Fortis Bank, Boulevard Jamar 1 D, 1060 Brussels, Belgium
IBAN	:	BE69 0012 3728 1678
BIC	:	GEBABEBB
Subject	:	Registration in the 64th ESReDA Seminar

Seminars Proceedings

The final proceedings of the 64th Seminar will be edited in the form of Technical Report and e-published with public access.

Venue

Faculty of Engineering – University of Deusto, Bilbao Campus

The University of Deusto was inaugurated in 1886. The concerns and cultural interest of the Basque Country in having their own university, as well as the interest of the Jesuits in establishing higher studies in some part of the Spanish State coincided in its conception. Nowadays, Bilbao is the center of a metropolitan area with more than one million inhabitants, a city traditionally open to Europe.

The central headquarters of the University of Deusto is located on the opposite side of the estuary, facing the Bilbao Guggenheim Museum, an emblematic symbol of the significant transformation of Bilbao during the last three decades. In 1916, the "Universidad Comercial de Deusto" received a group of students who would be the first graduates in Economic Sciences in Spain.

The institution is located on two campuses: Bilbao and San Sebastian and headquarters in Madrid and Vitoria. It counts with 10.000 students, 600 professors and 1200 invited professors. As Jesuit University, Deusto is a part of an international network, formed by 202 educational institutions that provide a pedagogical tradition centered on the person as essential value.

How to get to Universidad de Deusto?

Link

Accommodation

Link

ANNEX

Doctoral Workshop on Digital Twins

This doctoral course provides a unique opportunity for doctoral students and researchers to delve into cutting-edge topics within the fields of digital twinning and inverse problems. This 3-day course will cover the following topics: Inverse Problems and their probabilistic treatment, Predictive/Proxi modelling using Machine Learning and Stochastic Approximation, BIM Technologies, and practical implementation Digital Twining. Throughout the course, students will engage in practical examples from state-of-the-art Digital Twin research projects and toy modeling. The course will conclude with a comprehensive summary of the framework and key takeaways.

This is an exceptional opportunity for MSc and PhD students and researchers to gain in-depth knowledge and practical insights into the exciting fields of digital twinning and inverse problems.

Programme

First day, 29th May

MODULE 1. Introduction to Digital Twinning
  o   What are digital twins (DT)
  o   Range of applications and opportunities
  o   Descriptive and forecasting DTs
  o   Playing "what if?"

MODULE 2. Introduction to Inverse Problems and their Probabilistic Treatment
  o   Forward and inverse problems - maps and their inverses
  o   Concept of well-posedness and its significance
  o   Issues when considering inverse problems
  o   Observational noise
  o   Estimation, inversion of non-invertible maps

MODULE 3.   Bayesian model updating and filtering and computational techniques
  o   Short recap of random variables, sample, expectation, probability
  o   Conditioning, Bayes's theorem, conditional expectation and conditional probability
  o   Connections with machine learning and model order reduction
  o   MCMC
  o   Approximate Bayesian Computation
  o   Kalman filters and Particle filtering
  o   Gauss-Markov Filter
  o   Mixture density network

Second day, 30th May

MODULE 4. Predictive/proxi modeling, explainability of models
  o   Machine Learning techniques
  o   Bias-variance trade-offs, generalization capability, validation techniques
  o   Ensemble tree methods and the SHAP analysis
  o   Deep neural networks
  o   Physics-based surrogate modeling
MODULE 5. Modeling using stochastic polynomials
  o   Orthogonal stochastic polynomials and the gPCE
  o   Computation of gPCE: direct integration, spectral methods
  o   Numerical integration
  o   Statistics and global sensitivities with gPCE
  o   Gaussian process estimation

Third day, 31st May

MODULE 6. BIM technologies and digital twinning
  o   Overview of existing techniques and their connection with the DT
  o   View of BIM technologies from industry
  o   Management-communication of DT

MODULE 7. Educative examples of the whole framework, summary

- o Toy modeling: explanation and configuration
- o Practicing session
- o Summary and conclusion of the doctoral school

Lecturers:
- Prof. Hermann G. Matthies (Technical University of Braunschweig, Germany)
- Prof. Najm Habib (SANDIA National Laboratories, USA)
- Prof. Juan Chiachio Ruano (University of Granada, Spain)
- Prof. Manuel Chiachio Ruano (University of Granada, Spain)
- Prof. Anna Kucerova (Czech Technical University, Czech Republic)
- Dr. Andras Benczur (SZTAKI:Artificial Intelligence National Laboratory, Hungary
- Dr. Noemi Friedman (SZTAKI:Artificial Intelligence National Laboratory, Hungary)