DRIVEN

Newsletter No 3

March 2022

Dear Readers,

Welcome to the third and final DRIVEN newsletter! In this bumper edition, we present news of the DRIVEN team's activities over the project's final year. The Covid-19 pandemic impacted many of the twinning exchanges envisioned at the start of the project. However, with travel restrictions being relaxed in recent months, there has been a veritable rush of staff exchanges.

This newsletter features articles on:

- DRIVEN project in the media.
- Seminars on machine learning.
- EUROMECH Colloquium 618.
- Doctoral Programme in Computational Sciences.
- PhD student exchanges.

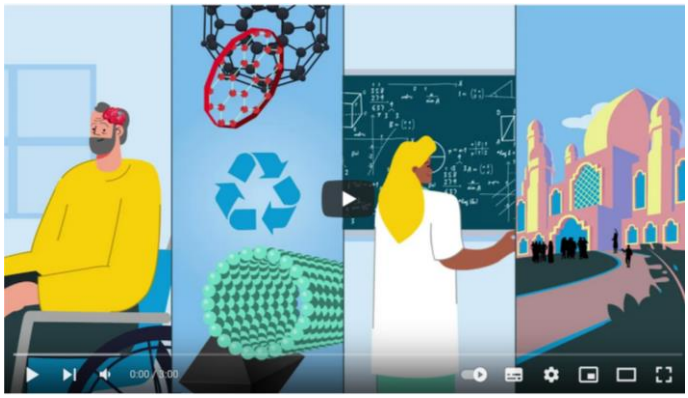
For more information, please visit our DRIVEN website.

DRIVEN Team

The DRIVEN project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 81199.

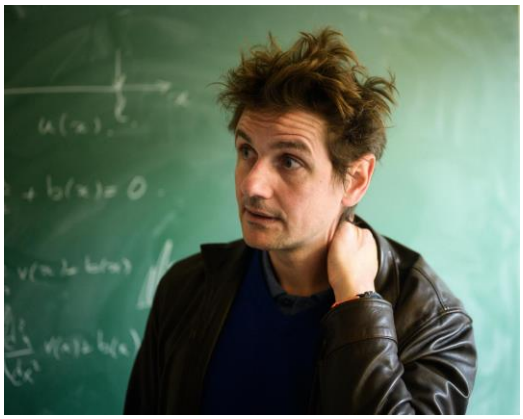
DRIVEN Youtube Video Published

A DRIVEN project video has been published on Youtube.



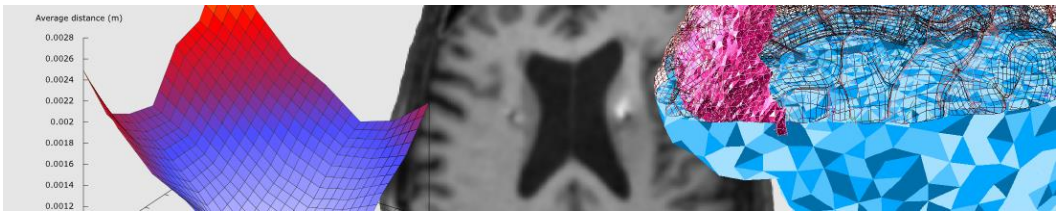
Interview with the DRIVEN Project Coordinator

The coordinator of DRIVEN project, Prof. Stéphane Bordas, was interviewed by the Letzebuerger Journal. In the interview, he discussed science, research in Luxembourg and, more generally, his life as a renowned mathematician. His inspiring interview was captured by the Letzebuerger Journal in a podcast that can be listened to via either of the following links: Journal.lu or Spotify



Seminar Programme on Machine Learning

Since October 2020, Prof. Stéphane Bordas (University of Luxembourg) has held regular seminars about machine learning open to the participation of the DRIVEN consortium partners.



The aim of the seminar series has been to harbour presentations of fundamental and methodological advances in data science and machine learning as well as to discuss application areas presented by domain specialists. The uniqueness of the seminar series lies in its attempt to extract common denominators between domain areas and to challenge existing methodologies. The focus is thus on theory and applications to a wide range of domains, including Computational Physics and Engineering, Computational Biology and Life Sciences, Computational Behavioural and Social Sciences.

The prolific seminar series has included not only speakers from the University of Luxembourg (e.g. Dr. Lars Beex and Arnaud Mazier) but also many speakers from other universities (e.g. Leibniz University, ETH Zurich, Oxford-Brookes University and Copenhagen University) and industry (e.g. BMW, Ceratizit and Microsoft).

By the end of March 2022, over 50 seminars had been held. To view the full seminar programme as well as the seminar abstracts and recorded videos, please click on the following link.

Online Course on Iso-Geometric Analysis

In June 2021, the Universities of Luxembourg and Limerick organised a joint online course dedicated to Iso-Geometric Analysis (IGA).

Prof. Stéphane Bordas gave three online lectures (Lecture1, Lecture2 and Lecture3) covering the following and more:

- Introduction to partition of unity
- Error bounds and enrichment
- Advances in mesh generation – the state of the art
- Limitations of standard elements
- Spline approximations and CAD
- Continuity requirements
- Interfaces and patch coupling
- Boundary element approaches
- Fracture mechanics applications
- Optimisation using IGA

Seminars about the FEniCS Project

Dr. Jack Hale (University of Luxembourg) has given the following seminars to promote the finite element software being developed within the FEniCS Project:

- "FEniCSx and SOFA?" presented online to the SOFA Technical Committee in February 2021.
- "DOLFINx and the Expression functionality for implementing complex constitutive models" presented online in May and November 2021.
- "DOLFINx: A new finite element solver for the FEniCS Project" to the Oden Institute, UT Austin, March 2022.

DRIVEN researchers support the FNR's "Chercheurs à l'école"

Every year, Luxembourg's National Research Fund (FNR) organises the "Chercheurs à l'école – Researchers go back to school", which encourages researchers from Luxembourg to meet school children and to share their passion for science.

For the 11th edition held in March 2021, Dr. Jack Hale visited the Lycée Ermesinde in Mersch together with Prof. Jens Kreisel, Vice-Rector for Research at the University of Luxembourg. It was the first time Dr. Hale had participated in "Chercheurs à l'Ecole", but certainly not the last. He really appreciated the talks with the students and their interest in his scientific career. During his presentation, Dr. Hale showed his R&D activities involving Goodyear Tire & Rubber and Rafinex.

Similarly, Dr. Katerine Saleme Ruiz visited the European School of Luxembourg and made a very interactive presentation to the students about her international career in mathematics and how to succeed in science.

Workshop on Doctoral Programme in Computational Sciences with PhD Presentations

The University of Luxembourg's DRIVEN team members were heavily involved in the organisation and running of a one-day workshop on 22 March 2022 dedicated to presenting the many research activities covered by the university's Doctoral Programme in Computational Sciences. Altogether, the workshop was attended by 127 participants (90 physically and 37 virtually).

Doctoral Programme in Computational Sciences
22 March 2022 @ MSA -1

	Schedule 22 March 2022		
TIME	**Activity**	**Speaker**	**Moderator**
9:00 AM	Welcome + presentation DRIVEN H2020	Stéphane Bordas	Vivienne Parry
9:05 AM	Presentation DTU DRIVEN	Andreas Zilian	Stéphane Bordas
9:10 AM	"A vision of the future: what can computational science deliver to address our major challenges"	James JB Kim - Data Design Engineering	Stéphane Bordas
9:15 AM	Q&A for industry	Vivienne Parry	Stéphane Bordas
9:25 AM	5 PhD pitches - "Environment"	Alper Bayram, Judith Meyer, Adnan Moussa, Ioana Popescu, Piergiorgio Vitello	Vivienne Parry
9:55 AM	Questions / Discussion	Commercial Industrial Audience + all audience	Vivienne Parry
10:05 AM	"how I see data and computational sciences in surgery"	Vincent Lubrano - neurosurgeon	Stéphane Bordas
10:10 AM	A question from Stéphane Bordas + answers from the audience	collective	Vivienne Parry
10:25 AM	Speed-collaborating	collective	Vivienne Parry
10:50 AM	*Break*		

Organisation of the EUROMECH Colloquium 618

EUROPEAN MECHANICS SOCIETY

COLLOQUIUM 618
UNCERTAINTY QUANTIFICATION IN COMPUTATIONAL MECHANICS
13 December – 14 December 2021, Luxemburg

Dr. Lars Beex (University of Luxembourg) chaired a EUROMECH Colloquium 618 dedicated to "Uncertainty Quantification in Computational Mechanics" in December 2021. The virtual colloquium was focused on the exploitation of data for increasing confidence in computational mechanics simulations. Key to this endeavour is the process of Uncertainty Quantification (UQ), which defines our potential in building accurate simulations of physical systems. The colloquium helped to facilitate in-depth knowledge transfer between the domains of UQ and Computational Mechanics. In total, 60 participants and 19 international presenters attended.

Online DRIVEN workshop during SOFA Week 2021

The University of Luxembourg held an online DRIVEN workshop in November 2021 as part of SOFA Week 2021. SOFA is an open-source platform for physics-based simulation first established in 2004 and run by INRIA in Strasbourg. SOFA Week is designed to gather the entire SOFA community, to present technological and scientific advances, while fostering networking within the community.

SOFA | Simulation Open Framework Architecture

PhD Student Exchange Visits between DRIVEN Twinning Partners

UL's PhD student Arnaud Mazier and INRIA's PhD student Sidaty El hadramy

The University of Luxembourg (UL) has been developing and using a software called FEniCS for numerical simulations. On the other hand, INRIA uses SOFA, another software for numerical simulations. After Arnaud Mazier (UL) presented his research work on FEniCS during SOFA week 2021, he visited INRIA in December 2021 and discussed with Sidaty El hadramy on the development of a SOFA plugin to enable to use FEniCS for creating new material models in SOFA for surgical simulation. The collaboration is expected to result in an open-access plugin and a scientific paper.

INRIA's PhD student Alban Odot

INRIA's PhD student Alban Odot has been co-supervised by Stéphane Cotin (INRIA) and Stéphane Bordas (UL). His PhD is focused on developing ways to speed up / improve Finite Element methods using Deep learning. In December 2021, he took the opportunity to visit UL. Also, within the framework of Bordas' seminars on machine learning, Alban presented a seminar entitled *Deformation approximation: Improve your Artificial Neural Network training using the Finite Element Method formulation. A case for static deformations*.

UL's PhD student Saurabh Deshpande

UL's PhD student Saurabh Deshpande is undertaking research towards the development of data-centric numerical models to simulate soft tissue deformations in real-time. As part of his research training, he visited INRIA's labs during March 2022.

Latest news

- Dr. Jack Hale, Dr. Michal Habera and Prof. Andreas Zilian visited UT Austin in March 2022 where they held extensive scientific discussions with researchers.
- Collaborating closely with Dr. Christian Goodbrake and Prof. Michael Sacks at UT Austin, UL has implemented an automatically differentiable eigenvalue / eigenvector decomposition in the FEniCS Project allowing to implement their new structural tissue model.
- DRIVEN partners produced five journal papers based on work undertaken during the project. These include papers in the International Journal of Number Methods, Computer Methods and Programs in Biomedicine, Advanced Modelling and Simulation, Computers and Chemical Engineering, and International Journal for Numerical Methods in Engineering. Full details can be found on the DRIVEN website.

Learn more on our DRIVEN project activities and achievements by visiting frequently our website:

2020driven.uni.lu

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