NEWSLETTER #1

GECKO is a Horizon Europe MSCA Doctoral Network that started on 1st January 2023. The main objective of the GECKO project is to bridge the existing gap between the CAD and the computational models (CAE) and integrate them within the industrial workflow by building "Design for IGA -type discretization workflows"

Building on an excellent consortium including top academic institutions and sector leading industrial partners, GECKO aims at enhancing the adoption of the technology within commercial solvers and adapting existing open source frameworks so that they can hook into the industrial practice and thus remain relevant in the foreseeable future.

On the 23rd-24th of February 2023, GECKO celebrated its Kick-off meeting in the coordinator's facilities of CIMNE in Barcelona, where only the supervisor and project managers were present.

Since April 2023, the Gecko Website https://gecko.cimne.com/ and Linked In page and the project Linked in page were established.

On the 10th of November 2023 an online meeting for the welcoming of the fellows took place, while on the 9th of January 2024 the 1st technical workshop took place online.
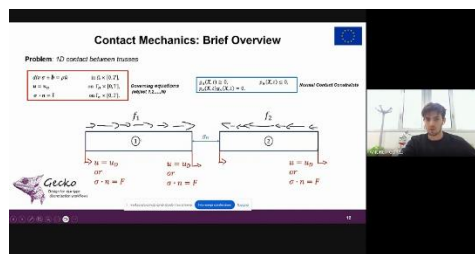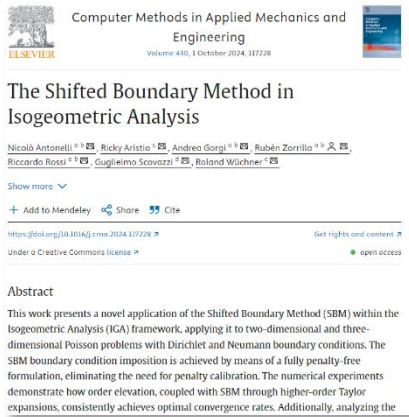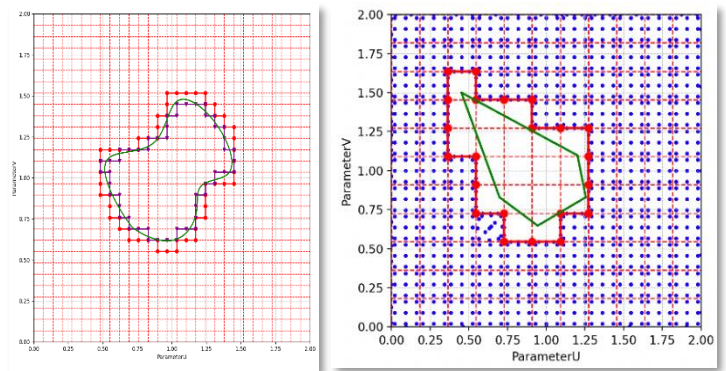

Between 29th of January and 2nd of February 2024 in the facilities of CIMNE the first trainings took place. The technical trainings included sessions on the "Theory and Fundamentals of IGA", "Hands on Programming basics" and "Basic and advanced programming in the open source code of Kratos". Additionally, a transversal skills course on Entrepreneurship, Technology Transfer & Valorization was conducted by CIMNE's TechTransfer Unit in collaboration with Across Legal.

By April 2024 all Doctoral Candidates were recruited. The group of doctoral candidates represent Italy, Spain, Greece, Germany, Argentina, Turkey, Jordan, China, therefore bringing together international talent from all over the world.

First Results and Publications

The work of DC1 Nicolo Antonelli includes the implementation of the IGA methodology within the Shifted Boundary Method framework, being the first time such a combination became possible. Optimal convergence of (p+1) order was achieved, a notable success given the challenges of working with SBM. An analysis of the stiffness matrix from the IGA-SBM integration was performed, focusing on its condition number. The results showed that SBM can avoid issues with small cut-cells, maintaining a stable condition number even in challenging scenarios.

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The Shifted Boundary Method in Isogeometric Analysis

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Abstract

This work presents a novel application of the Shifted Boundary Method (SBM) within the Isogeometric Analysis (IGA) framework, applying it to two-dimensional and three-dimensional Poisson problems with Dirichlet and Neumann boundary conditions. The SBM boundary condition imposition is achieved by means of a fully penalty-free formulation, eliminating the need for penalty calibration. The numerical experiments demonstrate how order elevation, coupled with SBM through higher-order Taylor expansions, consistently achieves optimal convergence rates. Additionally, analyzing the

This work was published in the top-ranked journal of the field Computer Methods in Applied Mechanics and Engineering on the 1st of October 2024.

In September 2024 a GECKO mini-sumposium was organized in the ISMA 2024 conference in Leuven, were DC1 Nicolo Antonelli, DC4 Juan Ignacio Camarotti, DC7 Angelos Pagonas and DC9 Philip Le had the chance to present the latest developments of their research.

Within the conference, the GECKO public technical workshop was organized, which attracted multiple conference

participants, showing a great interest in the topics and the results of GECKO. For the purposes of the course, a number of industrial speakers were invited to talk about industrial application of IGA. Specifically, DYNAmore (Ansys), Applus + IDIADA, BMW Group and the technical Hochschule of Regensburg were represented, underlining the significant industrial relevance of the GECKO topics.

WELCOME TO GECKO!

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