Project Objectives

The overarching objective of **ARIA** (**Accurate Roms for Industrial Applications**) project is to form an international and intersectoral network of organizations working on a joint research program in numerical modelling, specifically in the fields of **model reduction and convergence between data and models**

Accordingly, we have organized our research activities around the following key objectives:

- Advance the state-of-the-art in projection-based ROMs by leveraging ideas from large eddy simulation (LES).
- Enhance data-driven modeling via data-geometry inference tools such as manifold learning, solution classification and clustering, adaptive sampling. Integrate ROMs into a multi-fidelity model chain using rigorous error indicators and assess performance in cases of industrial and applicative interest.

ARIA project will lead to major advances in capability and understanding of the nonlinear dynamics of unsteady multi-scale flows and related phenomena. The research has the potential to impact on modelling the nonlinear dynamics of a much wider range of complex phenomena.

ARIA project will create a mutual interaction which is beneficial for both academic and industrial partners. ARIA will serve to establish a common training ground in application of inputs from the different reduced-order and machine-learning modelling techniques. This permits excellent research to be engaged with industrial needs.

The ARIA Consortium

The consortium consists of project partners across Europe from Italy, France, Germany and Spain.

There are three associated partners from the United States

Technical/scientific coordination:
Angelo Iollo - Inria Bordeaux, France

Contact us: aria-contact@inria.fr

More Information at: http://rise-aria.eu/

Follow us on Twitter @aria_h2020

Accurate ROMs for Industrial Applications

Accurate ROMs for Industrial Applications (ARIA)

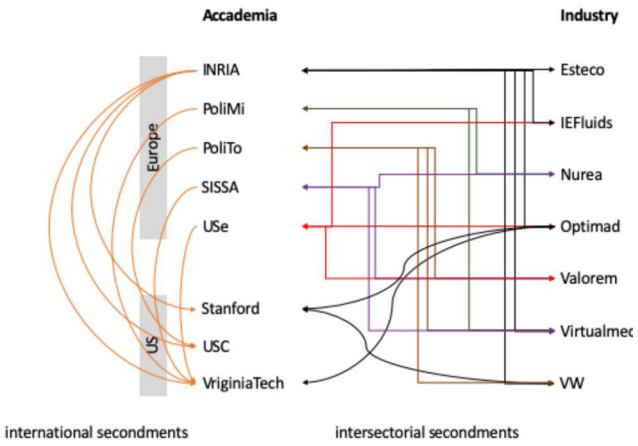
www.rise-aria.eu

This project receives funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement N° 872442

Knowledge Exchange & Secondments

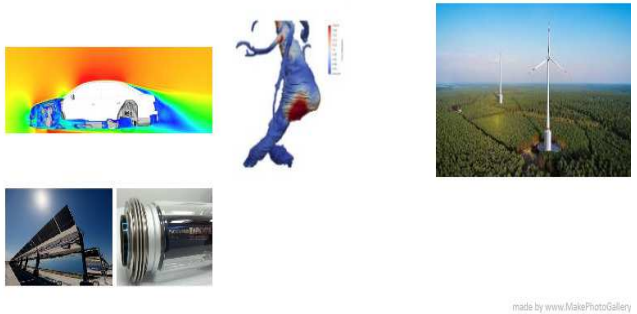
The knowledge sharing strategy is to circulate among partner staff new ideas and to diffuse them to the larger scientific community.

- **Inria**: basis interpolation, sampling, hybrid full-order, low-order approaches
- **University of Torino**: approximation theory, UQ
- **University of Seville**: ROM filtering for turbulence modelling
- **SISSA**: ROMs for cardiovascular problems and geometrical optimization.
- **University of Milano**: ROMs for flow modeling in pipes and adaptive model reduction
- **VirtualMech**: energy applications, LES-ROMs
- **Valorem**: wind mills applications
- **Optimad**: optimization software based on ROMs, data re-usage
- **Volkswagen (VW)**: ROMs for vehicle aerodynamics and optimization
- **ESTECO**: multi-disciplinary design optimization
- **Nurea**: decision making support software for vascular diseases
- **IEFLUIDS:** LES, multiphase flow and complex geometry treatment



Participants to ARIA project will exchange skills and knowledge through secondments and thematic workshops, which will allow them to progress towards key advances in **modeling multi-scale nonlinear physical phenomena**.

Thanks to knowledge exchange via secondments, ARIA project will strengthen collaborative research between different countries (France, Germany, Italy, Spain) and sectors fostering **applications in industrial flow control and optimization, and computer assisted surgery**. Advances in flow control and optimization will have potential market opportunities for non-academic participants in the project towards **greener terrestrial vehicles, more efficient wind farms, revolutionary cost-efficient prediction software's, and decision-making support tools for diagnostic and prognostic of vascular diseases,** with a significant benefit for European society.



The staff members who participate in the project will develop new skills **in data-driven physical modeling**, be exposed to new research environments and have their career perspectives widened thanks to a cutting-edge expertise. Even with rapid advances in software information technology and hardware computer technology, certain biological and physical systems remain beyond our ability to mathematically model and compute. Junior staff of this project will be formed to an array of mathematical methods for constructing **predictive ROMs with guaranteed robustness, reliability and efficiency** for applications involving these extremely complex physical phenomena

Project Work packages

WP1 – Management
WP Leader - Inria

WP2 – ROMs for incompressible turbulent and unsteady flows
- To develop advanced reduced order methods (RB, POD, HiMod) for turbulent and unsteady flows, particularly for LES
- To develop state-of-the-art reduced order models, to be applied in realistic industrial applications and medical applications considered in WP4

WP Leader – University of Seville

WP3 - Data Topology Inference
- To improve the robustness of the Reduced Order Subspace w.r.t. input parameters
- To evaluate the interaction between ROM and industrial grade MDO framework
- To develop and investigate the performances of families of Stochastic Collocation methods coupled with suitable Multifidelity models

WP Leader – ESTECO

WP4 - Industrial and medical applications
- To identify key industrial requirements/medical indices, constraints and Key Performance Indicators (KPIs)
- To identify test cases, make them available to the ARIA consortium and to quantify the KPIs

WP Leader - OPTIMAD