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IFPEN and Inria are launching a strategic partnership on high-performance simulation and Artificial Intelligence (AI) for the exploitation of data to support the energy transition

The collaboration between IFPEN and Inria forms part of the effort to accelerate the development of new competitive and environmentally-friendly technologies, in line with the ambitions of the French National Low-Carbon Strategy (SNBC).

The reinforcement of the existing agreement, extended to the energy transition

In 2015, IFPEN and Inria signed a framework partnership agreement in the field of high-performance computation (HPC) and real-time computation applied to energy optimization and the environment. The success of the joint research conducted by the two organizations highlighted the benefits of pooling their expertise and underlined the importance of combining advances in the field of digital technology with the development of innovations for the energy transition.

The new “HPC/AI/HPDA Convergence for the Energy Transition” joint research laboratory reinforces and extends the scope of the partnership to include artificial intelligence (AI) and high-performance data analysis (HPDA). It will be jointly led by the scientific divisions of the two organizations, with an initial budget of €2 million.

The first fields of interest

Five research themes have already been jointly identified, and will be launched in October 2020, to support the development of digital twins and design numerical tools aimed at researchers to facilitate innovation:

- floating wind turbine modeling and monitoring
- the acceleration of simulations based on complex modeling
- assisted discovery via the molecular simulation of new catalysts for converting raw materials (biomass, solar energy) into biofuels and bioproducts
- 4D modeling of the evolution of sedimentary basin deformation over time
- knowledge management and assisted selective research via AI approaches

concerning multiform documentary data.

For Pierre-Franck Chevet, Chairman and CEO of IFPEN *“This new partnership illustrates our shared determination to exploit digital transformation technologies for the benefit of the energy transition, and thereby contribute to the development of technological innovations.”*

Bruno Sportisse, Chairman and CEO of Inria comments: *“The intensification of our collaboration is part of the dynamics of Inria's new contract of objectives and performance, Ambition Inria 2023. The complementary nature of our expertise will make it possible to both pose and solve scientific challenges and to accelerate the dynamics of innovation”.*

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LES BRÈVES

Digital technologies are playing an increasingly important role in solving industrial problems. Conscious of the need to combine its expertise with that of digital technology experts in order to develop its new energy innovations, IFPEN forged a partnership with Inria. Five years later, we look back over this fruitful partnership.

In 2015, IFPEN signed a framework agreement with Inria in **the field of high-performance computation (HPC) and real-time computation applied to energy optimization and the environment**. Research focused more specifically on three of the nine scientific challenges that underpin IFPEN's fundamental research and help optimize performance in the digital technology field.

Make better use of hybrid vehicle propulsion energy using a new algorithm

First of all, challenge 7 ("Control and optimization of complex systems") increasingly requires the development of simulation tools capable of overcoming the absence of some components to determine the behavior of a system. Real-time simulation in particular offers the possibility of **incorporating absent components to perform the calculations required for decision-making**.

Within this context, a PhD thesis focused on the optimized use of energy on board hybrid vehicles in order to exploit the potential of this technology in terms of reducing CO2 emissions. The new algorithm developed, called the energy management system (EMS), made it possible **to strike the right balance between the use of the IC engine and the electric motor as a function of traffic conditions**, a factor that had not previously been taken into account in the modeling process.

Digital simulation: faster computation thanks to adaptive methods

Within the framework of this partnership, research teams also worked on challenge 8 ("digital and IT performance of computational codes") **aimed at optimizing the use of new, constantly evolving digital architecture computational resources**.

For example, they developed calculation time acceleration strategies via the development of new methods to obtain the optimization of the mesh required by digital simulation. Thanks to refinement algorithm management, these methods enable dynamic mesh adaptation.

Fostering dialog between data analysis experts

Lastly, to help address challenge 4 ("massive data flows") by encouraging dialog between experts, IFPEN and Inria co-organized Datascien'2018, an inter-disciplinary conference bringing together researchers, software developers and industrial players to discuss **the theme of data analysis**.
>>To find out more, consult the summary of this event.

Expanding and reinforcing the partnership

The success of the research described above having demonstrated the benefits of pooling their expertise, IFPEN and Inria have decided to **reinforce their partnership by expanding their research to include Artificial Intelligence (AI) and high-performance data analysis to support the energy transition**.

The new partnership will hinge around the launch of a joint research laboratory, called “HPC/AI/HPDA Convergence for the Energy Transition”, for which five fields have already been selected:

- floating wind turbine modeling and monitoring
- the acceleration of simulations based on complex modeling
- assisted discovery via the molecular simulation of new catalysts for converting raw materials (biomass, solar energy) into biofuels and bioproducts
- 4D modeling of the evolution of sedimentary basin deformation over time
- knowledge management and assisted selective research via AI approaches concerning multiform documentary data.

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