STRENGTHENING NUCLEAR POWER THROUGH INNOVATION IN SAFETY ANALYSIS

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For decades, nuclear energy has been contributing to top-level worldwide human society drivers, such as environmental sustainability, security of energy supply and, no less important, economic competitiveness. In the current international context, where full decarbonization in the heat, transport, industry, and electricity sectors has become the goal to achieve, nuclear energy is being considered a key enabler. Therefore, nuclear safety of existing, under construction, and upcoming innovative reactors should be kept as the top priority of nuclear technology, and its continuous optimization should remain in the research agenda.

Severe accidents (SA) are known to be the major contributors to the overall risk of nuclear power plants (NPP), even if such a risk is very low. . The approach and capabilities to model these events have a primary importance to achieve even higher safety standards. On one side, numerical simulation is a central element of the safety demonstration, where the compliance of the main safety features of a NPP is checked against highly demanding requirements. On the other side, the development and optimization of accident management (AM) measures, aimed to prevent and mitigate the consequences of SAs, heavily rely on a large number of numerical simulations with SA codes.

The HORIZON-2020 project on "Management and Uncertainties of Severe Accidents (MUSA)" represented a significant step forward in the application of Uncertainty and Sensitivity Analysis (UaSA) in Severe Accidents (SA) analysis. While a massive application was conducted for reactor and Spent Fuel Pool (SFP) scenarios, major challenges were found that might hinder an effective and systematic implementation of UaSA in the SA domain.

This paper shortly synthesizes the major accomplishments achieved by MUSA and focuses on what remains to be done to eventually consolidate UaSA as a ready and feasible innovative approach in the analysis of SA. By doing so, deeper and more robust insights into SA analysis of current and future reactor designs will result in an optimized management of these unlikely events and an awareness of uncertainties associated to SA simulations. No less important, UaSA will identify areas where research would substantially reduce uncertainties, allowing a wiser focus of forthcoming research.

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