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Description

The project ORION is aligned with the goals of decarbonization of the European transportation sector and Europe's vision to achieve net zero greenhouse gas (GHG) emissions by 2050. ORION intends to perform a Proof of Concept of a swirl low-NOX burner using a secondary hydrogen stream that contributes to mitigate stability problems found in swirl-stabilized lean premixed burners of gas turbines.

ORION proposes a novel design concept to increase the operational envelope to operate hydrogen flames efficiently and with low emissions. This strategy is based on the concept of partial premixing where the lean premixed flame interacts with a secondary fuel injection that introduces hydrogen flow rates into the swirl flame altering the flame structure and combustion dynamics. This work will be carried out thanks to the collaboration between Barcelona Supercomputing Center (BSC) and the CMT-Motores Térmicos Institute (CMT) from the Universitat Politècnica de València (CMT). The former group will contribute with its long experience in computational fluid dynamics (CFD) and high performance computing, as well as previous work in the study of hydrogen burners and swirling flames. CMT will contribute with an experimental facility with strong capabilities to develop this type of burners, with advanced optical diagnostic techniques, which will make it possible to analyze the performance of the different variants in detail.

ORION is designed as a collaborative effort between BSC and CMT with two subprojects that are led by each institution based on their background and expertise. BSC will lead the ORIONc subproject, which is focused on the numerical characterization of the technological solutions using high-fidelity simulations and the design optimizations using data-driven methods with Artificial Intelligence. CMT will lead the ORIONe subproject, which is focused on the manufacturing and operating the burner in the experimental facility, the experimental testing and the comparison of results with calculations, so that the best configurations can be chosen for the final burner. As the use of hydrogen in gas turbine applications is still placed at a very low TRL level, it demands for a huge investment in terms of research and development of low TRL technologies.

Barcelona Supercomputing Center - Centro Nacional de Supercomputación

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