**University of Leicester**

**Future 50 PhD Scholarship**

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| **Project Reference** | ENG Zhang |

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| **Additional Supervisor** |  |

**Section 2 – *Project Information***

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| **Project Title** | Hydrogen-based novel propulsion technologies and design framework for future sustainable aviation |
| **Project Highlights:** | 1. | Development of novel cycle design methods, thermodynamic modelling for hydrogen-based propulsion systems, as well as hydrogen storage systems design. |
| 2. | Integration of hydrogen-based novel propulsion technologies into aircraft design modelling platforms. |
| 3. | Evaluating the propulsion system performance at integrated system/aircraft level from techno-economic-environmental perspectives. |
| **Project Summary**  |
| By the year 2050, a greater than 60% increase in global commercial air travel seat miles and a 38% increase in energy use can be envisioned with corresponding CO2 emissions projections of 209 million metric tons CO2e. The negative environmental impact of air travel is considerable. And the civil aviation sector plays a significant role in transport and energy sustainability in environmental, economic, and social dimensions. The UK government's recent Transport Decarbonisation Plan targets for Accelerating Aviation Decarbonisation to reach net zero by 2050 [1]. To completely decarbonize the complex and carbon-intensive aviation sector, hydrogen-based propulsion technologies are recognized as the promising solutions. This project aims to explore the application of hydrogen technologies (both fuel cell and hydrogen combustion) in sustainable aircraft propulsion and further develop methods and tools towards model-based propulsion architecture design, integration, and assessment for novel aircraft concepts. The research activities for this position include:* Development of novel cycle design methods, thermodynamic modelling and simulation methods for hydrogen-based engine systems, further proposing performance evaluation methods of physics-based emission prediction model, gas turbine life cycle assessment model, etc.
* Hydrogen storage systems design and integration (liquefied hydrogen, compressed gaseous hydrogen, etc.), accounting for fuel tank weight and volume, thermal management, and gravimetric efficiency.
* Integration of hydrogen-based novel propulsion technologies into aircraft design modelling platforms with novel airframe configurations (high aspect ratio, strut-braced, boundary layer ingestion, etc.), then developing mission performance analysis methods accounting for propulsive-airframe and cross-propulsor interactions.
* Techno-economic-environmental assessment of novel hydrogen-based propulsion technologies, investigating the prerequisites to achieve cost-effectiveness and further informing the future environmental, energy, and transport policies.

The applicant should have an interest in aerospace propulsion, and sufficient knowledge of programming in Matlab and python is desirable. [1] Decarbonising transport: a better, greener Britain, Department for Transport, 14 July 2021. |