World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:19, No:02, 2025

The Harmonious Blend of Digitalization and 3D Printing: Advancing Aerospace Jet Pump Development

Authors : Subrata Sarkar

Abstract : The aerospace industry is experiencing a profound product development transformation driven by the powerful integration of digitalization and 3D printing technologies. This paper delves into the significant impact of this convergence on aerospace innovation, specifically focusing on developing jet pumps for fuel systems. This case study is a compelling example of the immense potential of these technologies. In response to the industry's increasing demand for lighter, more efficient, and customized components, the combined capabilities of digitalization and 3D printing are reshaping how we envision, design, and manufacture critical aircraft parts, offering a distinct paradigm in aerospace engineering. Consider the development of a jet pump for a fuel system, a task that presents unique and complex challenges. Despite its seemingly simple design, the jet pump's development is hindered by many demanding operating conditions. The qualification process for these pumps involves many analyses and tests, leading to substantial delays and increased costs in fuel system development. However, by harnessing the power of automated simulations and integrating legacy design, manufacturing, and test data through digitalization, we can optimize the jet pump's design and performance, thereby revolutionizing product development. Furthermore, 3D printing's ability to create intricate structures using various materials, from lightweight polymers to high-strength alloys, holds the promise of highly efficient and durable jet pumps. The combined impact of digitalization and 3D printing extends beyond design, as it also reduces material waste and advances sustainability goals, aligning with the industry's increasing commitment to environmental responsibility. In conclusion, the convergence of digitalization and 3D printing is not just a technological advancement but a gateway to a new era in aerospace product development, particularly in the design of jet pumps. This revolution promises to redefine how we create aerospace components, making them safer, more efficient, and environmentally responsible. As we stand at the forefront of this technological revolution, aerospace companies must embrace these technologies as a choice and a strategic imperative for those striving to lead in innovation and sustainability in the 21st century.

Keywords : jet pump, digitalization, 3D printing, aircraft fuel system.
Conference Title : ICAA 2025 : International Conference on Aeronautics and Aeroengineering
Conference Location : Sydney, Australia
Conference Dates : February 25-26, 2025