news DIGI3D

Students Gathered up in LTT-2 !

Students from all partner institutions came together between **27 April and 1 May 2026 in Aveiro, Portugal**, to participate in the **LTT-2 event** organized within the **DIGI3D**. The event was hosted by the staff of the **Department of Mechanical Engineering at the University of Aveiro**, who prepared a comprehensive program combining theoretical lectures, practical activities, technical visits, and student-centered activities.

During the event, researchers from the University of Aveiro delivered an informative lecture focusing on the **design aspects of 3D printing technologies**. The lecture introduced students to important design considerations and demonstrated how digital design approaches can be effectively integrated into additive manufacturing processes.

As part of the practical activities, students visited the **Digital Technology Facilities at the Centre for Mechanical Technology and Automation (TEMA)**. This visit provided participants with the opportunity to observe advanced digital manufacturing technologies and gain a better understanding of their applications in modern engineering and 3D printing.

A student competition focusing on the **design and manufacturing of 3D-printed polymeric components** was also organized during the event. This activity encouraged students to apply their theoretical knowledge in a practical context while developing their creativity, problem-solving skills, and teamwork abilities. In addition, participants were introduced to various **digital tools and software applications** used in contemporary 3D printing workflows.

The **case studies and practical applications related to the 3D printing of polymeric materials** attracted considerable interest among the students. These activities helped participants connect theoretical concepts with real-world applications and provided valuable insights into the role of digital manufacturing technologies in the aerospace and engineering sectors. LTT-2 offered an engaging and collaborative learning environment, strengthening knowledge exchange and cooperation among students and partner institutions.

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3D Printing of Polymeric Materials in Aerospace Applications

3D printing, particularly fused deposition modeling (FDM) and fused filament fabrication (FFF), has gained increasing attention in the aerospace industry due to its ability to produce lightweight, complex, and customized components with reduced material consumption and manufacturing time. Engineering thermoplastics such as PEEK, PEI, PA, PPS, and ABS offer attractive properties, including low density, good mechanical strength, thermal stability, and chemical resistance, making them suitable for various aerospace applications such as brackets, housings, ducts, fixtures, and interior components.

Despite these advantages, the layer-by-layer nature of FDM/FFF introduces several limitations, including anisotropy, interlayer defects, porosity, and relatively high surface roughness. These characteristics can significantly influence the mechanical strength, fatigue resistance, dimensional accuracy, and tribological behavior of printed components. In particular, surface morphology and printing-induced anisotropy can affect friction and wear performance, which are important considerations for polymer components subjected to sliding or contact conditions.

Surface modification and coating technologies provide promising approaches to overcome these limitations. Diamond-like carbon (DLC) coatings, for example, are characterized by high hardness, low friction, and excellent wear resistance. Applying DLC coatings to appropriately prepared 3D-printed polymer surfaces may therefore enhance their tribological performance and expand their potential use in aerospace applications. Understanding the relationship between printing parameters, surface characteristics, coating adhesion, and tribological behavior is essential for developing reliable and high-performance additively manufactured polymer components.

3D Printing Activities within DIGI3D

The DIGI3D partners have been actively investigating and developing 3D printing processes, with particular emphasis on optimizing manufacturing parameters and adapting additive manufacturing operations to specific aerospace materials. Various printing methods and process conditions have been studied to improve the quality, accuracy, and surface finish of 3D-printed components. Students have also played an active role in these activities, with final-year students increasingly undertaking 3D-printing-related projects as part of their graduation courses.

One notable example is the production of a 3D-printed fan blade designed as a commemorative gift. Students from the Aeronautical Engineering Department at ESOGU dedicated considerable effort to producing fan blades with a smooth and high-quality surface by systematically optimizing the printing parameters and process conditions. Following the optimization and finalization of the manufacturing process, a set of fan blades was produced to be presented as commemorative gifts to the host organizations during dissemination visits.

The commemorative gift produced by ESOGU students

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