ME Seminar

MECHANICAL ENGINEERING
INDIAN INSTITUTE OF SCIENCE

Additive Manufacturing of advanced polymer composites for high potential applications

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ABSTRACT

Additive manufacturing (AM) has introduced a novel production method in design, manufacturing, and distribution to end-users. As the potential applications for 3D printing increase, companies are beginning to find ways to create new business models and opportunities with the technology. Predominantly, high-value applications like the medical and aerospace industries are working to meet their tough performance standards and requirements. The talk addresses the scientific questions arising when establishing a new or alternate material for the additive manufacturing process. Particularly, the selective laser sintering (SLS) process is a rapid manufacturing technology for producing end-use components using thermoplastic polymers. The commercially successful thermoplastics base has the challenges like warping, curling and delamination. To overwhelm the above difficulties, the current research focuses on material development.

On the other hand, the thermomechanical properties of the SLS 3D printed thermoplastic objects are unsuitable for high-load bearing or wear-resistant applications, which emerges in developing novel polymeric material powders with improved Z-direction strength. The SLS processing of thermosetting polymers is precious to achieve parts with high thermomechanical/chemical stability and abrasion resistance. In addition, it highlights the potential of fusing robotic Automated Fibre Placement (AFP) and AM processes to fabricate complex 3D polymer-based lightweight composite parts for aerospace wings and prosthetics applications. Combining these two processes suggests a promising option for composite materials development, improving composite structures in terms of complexity and customizability. Significantly, it presents the adopted research methodology, background research, and the design, development and set-up of an experimental robotic work cell that fuses AM and AFP.

ABOUT THE SPEAKER

Rajkumar Velu, PhD, is an Assistant Professor at the Indian Institute of Technology, Jammu. Currently, visiting research associate and priory worked as a Research Fellow at the Centre for Laser Aided Intelligent Manufacturing (CLAIM), University of Michigan, USA, and also as a Post-Doctoral Research Fellow at the Digital Manufacturing and Design Centre (DManD), Singapore University of Technology and Design, Singapore. He completed his PhD thesis in selective laser sintering of specific biopolymer composites for biomedical application at the Auckland University of Technology, New Zealand. Dr Velu engaged in research on additive processing since 2012, its emergence as a new technology, and focused on developing the materials and experimental infrastructure for conducting fundamental and applied research in this domain. Infrastructure developments include in-house test beds constructed for research. The focus has been on actual work leading to the invention of new material alternatives, process planning and enhancements, and modeling.

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