One Week High-End Workshop on

ADVANCES IN METAL ADDITIVE MANUFACTURING: FUNDAMENTALS, MODELING, AND MATERIALS WITH FUTURE RESEARCH POTENTIAL

July 02-08, 2023

Department of Mechanical Engineering, National Institute of Technology Calicut

A curtain raiser event for COPEN-13: 2024

Coordinator: Dr. Basil Kuriachen

PREAMBLE

Additive manufacturing (AM) of metals offers highest production flexibility, almost unlimited freedom of design and the potential for pointwise control of microstructure and mechanical properties. However, a sub-optimal choice of process parameters often leads to high residual stresses, dimensional warping, porosity, undesirable microstructures or even failure of the part during production. The main objective of this course is to convey the physical fundamentals of metal AM processes, the basics of process implementation and monitoring, material aspects as well as modeling and simulation techniques on different length scales. The course begins with an overview of existing metal AM processes comprising powder bed fusion additive manufacturing (PBFAM), e.g. selective laser melting (SLM), selective laser sintering (SLS), electron beam melting (EBM), directed energy deposition (DED), binder jetting (BJ), and material droplet printing (MDP). After conveying the physical fundamentals, potential fields of application and the technical implementation, means of monitoring and process control are presented. Different types of defects in metal AM are categorized and strategies for defect detection via in-situ and ex-situ metrology (e.g. X-Ray computer tomography CT, density inspection, geometry control) are discussed. Moreover, the course will convey essential material aspects such as the principles, mechanisms and kinetics of solidification as well as the fundamentals of equilibrium and non-equilibrium thermodynamics. Phase formation and microstructure control, alloy design, powder metallurgy and process-microstructure-property correlations will be discussed in the context of metal AM and compared to conventional casting.

A further focus of the course lies on modelling and simulation approaches in metal AM, covering the underlying modelling assumptions, governing equations, discretization strategies as well as numerical aspects (e.g. balance of computational efficiency and solution accuracy). ach set of lectures will start from the respective basics but will then quickly move on to cutting-edge research topics. The lectures are primarily designed for doctoral students of mechanics, engineering, material sciences and physics with a strong interest in the different research aspects of metal AM. However, they are equally suited for young and senior researchers who would like to gain a

comprehensive overview in an efficient compact course format. It might also be interesting for practicing engineers working on high-level industrial applications of metal AM.

ABOUT NIT CALICUT

National Institute of Technology Calicut (NITC) is one of the 31 institutions of national importance governed by the NIT Act 2007 and is fully funded by the Government of India. Originally established in 1961 as a Regional Engineering College (REC), it was transformed into a National Institute of Technology in the year 2002. The Institute offers bachelors, masters and doctoral degree programmes in Engineering, Science, Technology and Management. With its proactive collaborations with a multitude of research organizations, academic institutions and industries, the Institute has set a new style for its functioning under the NIT regime. The Institute is presently offering eleven UG programme and thirty PG programme along with Ph.D. programme in various fields of Engineering, Science Technology and Management; http://www.nitc.ac.in

ABOUT COPEN-13: 2024

The Conference on Precision Engineering (COPEN) was spearheaded by IIT Madras in 2000 to bring the academicians, researchers and practicing engineers for sharing their experiences in the field of precision engineering. It has gained wide acclaim over the years and reached an international status in 2006. The thirteenth international conference is being organized by National Institute of Technology Calicut during December 13-15, 2024. For more information, please visit: http://www.copen.ac.in/index.html

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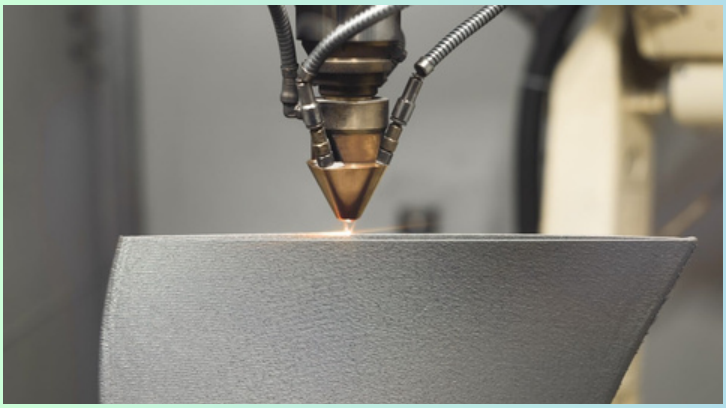

ABOUT MECHANICAL ENGINEERING DEPARTMENT AND ADVANCED MANUFACTURING CENTRE@ NITC

Department of Mechanical Engineering is the largest and one of the oldest departments in the Institute. The Department offers two undergraduate and six postgraduate programmes apart from Ph.D. programmes in diverse specializations. It offers a number of short term/continuing education programmes. It is a DST-FIST sponsored department and recently DST has sanctioned Rs 2.51 Crore under FIST scheme to set up a Centre for Precision Measurements and Nano Mechanical Testing. Advanced Manufacturing Centre in the department has one of the finest facilities available in manufacturing; http://www.amc.nitc.ac.in/

MAJOR TOPICS

Metal Additive Manufacturing, Powder Bed Fusion AM, Binder Jetting, Material Droplet Printing, Directed Energy Deposition, Modeling and simulation approaches in AM, Types of defects in AM, Post processing and testing in AM, Tribology of AM components, AM for Electronic applications, 3D printed polymers and polymer matrix composites, Fatigue and fracture of AM components, AM for Defense and Aviation applications, Application of AM in Medical industry, Mechanical testing of AM materials,Artificial intelligence and Machine learning in AM, AM standards and practices

CONTACT DETAILS

Dr. Basil Kuriachen - bk@nitc.ac.in / 9947187133
Assistant Professor
Advanced Manufacturing Centre
Department of Mechanical Engineering
National Institute of Technology Calicut - 673601

PARTICIPANTS: ELIGIBILITY CRITERIA

- Category-I: Regular PG or Ph.D. students pursuing their degree from AICTE-approved institutions within India are eligible to apply (No registration Fee).
- Category-II: Interested Faculties/ Practicing Engineers (self financing mode). A registration fee of Rs.7,000/- need to be paid by such applicants if selected.
- The applicants should produce the Application cum Endorsement form (prescribed format) from the Supervisor/Head of the Department/ Institute, allowing their student to undergo training in the workshop if selected.

REGISTRATION AND CERTIFICATION

- Maximum attendees: 25 (selection based on merit and first come, first serve basis).
- Online registration form link: https://forms.gle/tm2WJzBGQcNCrLSbA
- Please fill the above Google form with the requested details and upload the scanned copy Application cum Endorsement form by 09th June 2023.
- The applications will be screened, and the candidates will be selected on merit. The selection committee's decision will be final in the selection of candidates.
- The selected candidates will be informed by email on or before 10th June 2023.
- The selected candidates will have to acknowledge participating in the workshop through a return email (on or before 13th June 2023), failing which the waitlisted candidates may be called to attend the workshop.
- Certificates will be provided to the participants after the successful completion of the workshop.
- The participants (Category-I) will be accommodated in Institute guest house/hostel rooms (if available) with catering facilities under the funds approved by SERB (as per norms).
- The participants (Category-I) will be eligible for TA reimbursement for their journey to the host institute from their hometown/home institute, both ways for the train or bus's lowest fare, as per the GoI norms.

IMPORTANT DATES

Last date for registration: 9th June, 2023
Intimation to participants: 10th June, 2023
Acknowledgment by participants: 13th June, 2023
Workshop dates: 02nd to 08th July, 2023

Department of Mechanical Engineering, National Institute of Technology Calicut, Kerala, India.

APPLICATION CUM ENDORSEMENT FORM

for High-End Workshop
(KARYASHALA)
on

"ADVANCES IN METAL ADDITIVE MANUFACTURING: FUNDAMENTALS, MODELING AND MATERIALS WITH FUTURE RESEARCH POTENTIAL"

(Physical mode)
(Under the Accelerate Vigyan Scheme – a SERB Initiative)
2nd to 8th July 2023
Department of Mechanical Engineering, NIT Calicut, Kerala-673601

Photograph

Name:
Category (PG/Ph.D./Faculty/Engineer):
Enrolment Number:
Year of Study (Experience):
CGPA/ Percentage secured till date (For Category-I):
Department:
Institute/University/Company:
Address:

Mobile:
E Mail:

The above information provided is true and to the best of my knowledge. If, selected, I agree to abide by the rules and regulations of the program.

Signature of Candidate

Signature and Seal with name
(Head of the Department/ Supervisor)