



INTRODUCTION TO MECHANICAL MICRO MACHINING

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PRE-REQUISITES : Conventional machining processes (lathe, milling, drilling, etc.)

INTENDED AUDIENCE : Mechanical, Manufacturing, Production.

INDUSTRIES APPLICABLE TO : Research institutes: Bhabha Atomic Research Center (BARC), Mumbai Central Mechanical Engineering Research Institute (CMERI), Durgapur Central Manufacturing Technology Institute (CMTI), Bangalore

COURSE OUTLINE :

The emergence of miniature and micro products / components has increased the demand of the production of micro components with feature size from a few millimeters to tens of micrometers. Mechanical micro machining is one of the key technologies to enable the realization of high accuracy complex micro products made from a variety of engineering materials. Mechanical micro machining is capable to machine metals, polymers, and ceramics in very less time as compared to lithographic processes and other micro machining processes such as EDM, ECM, LBM, etc. As a result, it has found strong base in a wide array of practical applications.

Though the machine for micro cuttings are kinematically similar to conventional machines, there are many differences in terms of process mechanics, machine components, etc. Hence, understanding of machining at micro scale is very important to process any material to the desired dimensions.

ABOUT INSTRUCTOR :

Prof. Ajay M Sidpara is a faculty in Mechanical Engineering Department at IIT Kharagpur. His research interests are on surface finishing at nano scale and micro machining for different applications such as optics, biomedical, micro fluidics, etc. He has extensively worked on development of different tooling for nanofinishing, micro machining and improvement of process efficiency using different strategies. He has published 26 journal papers, 12 book chapters, and many conference papers related to nanofinishing and micro machining. 3 patents are filed related to his research work. He has received funding from SERB, BRNS and GE Power India. He has received Gandhian Young Technological Innovation Award 2013, Young Engineers Award 2015 from IE (India), and CSR innovation award from GE Power India Limited (erstwhile ALSTOM India Limited). He is a reviewer of more than 20 international journals and also delivered around 20 invited talks in the institutes, and research labs.

COURSE PLAN :

Week 1: Experimental observations and theoretical prediction of constituents of an atom

Week 2: Scaling law

Week 3: Mechanical micro machining (process, mechanism)

Week 4: Burr formation, surface roughness, built up edge

Week 5: Cutting fluid, run out, grain size

Week 6: Micro machine structure - I

Week 7: Micro machine structure - II

Week 8: Fabrication of micro cutting tools

Week 9: Miniature machine tools

Week 10: Diamond Turning (process, types, mechanism, applications)

Week 11: Metrology for micro machining

Week 12: Sensor integration for process monitoring