List of Projects proposed for MTech Students (2011-12)

AEAMT Dept:

	Description	Guide	Duration	Subject
1	Development of SOFTPLC Software	S.SatishKumar / L.Sudha	6 months	ComputerScience / Electronics / Programming/Instrumentation
2	Development Wireless Communication system	S.SatishKumar / L.Sudha	6 months	Electronics & Programming Hardware Design

1. Development of SOFTPLC Software:

Programmable Logic Controller is generally a hardware device used for controlling machine/equipment process, input/output logics. SoftPLC emulates hardware PLC in the process of Input/Output and logic control. SoftPLC software has to developed to execute in PC. In SoftPLC the PC processor acts like a PLC processor and for implementing digital input/output and other interfaces for physical connectivity to the outside world will be established by means of an add on card plugged into the PC.

Project Guide: S.Satish Kumar / L. Sudha
Stream: Computer Science / Electronics / Programming / Instrumentation

2. Development Wireless Communication system

Wireless communication system has to receive/send the signal from the PC through DAQ card and send/receive to the sensor. The project includes the Listing of features & functionalities of wireless system hardware and software
Design, Design of Wireless Transceiver Circuitry, Assemble the components on the PCB and testing by connecting between PC and sensors.

Project Guide: S.Satish Kumar / L. Sudha
Stream: Electronics & Programming, Hardware Design

MNT Dept

Sl No	Research Theme	Guide	Duration	Discipline
1.	Study on Temperature Control of Media in Abrasive flow machining	N.Balashanmugam	8 months	Mechanical

2.	Static and Dynamic analysis of Hydrostatically Clamped Turning Tool used in High Precision Machining	N.Balashanmugam	8 months	Mechanical
3.	Analysis of Tool wear in Turning by Hydrostatically clamped turning tool	N.Balashanmugam/V.Raju	8 months	Mechanical
4.	Study on Deterministic Surface Roughness generation using micro EDM	N.Balashanmugam/V.R.Raju	8 months	Mechanical
5.	Study of UV laser Spot Size and polymerization of HDDA material in Micro Stereo Lithography (MSL) process	N.Balashanmugam	8 months	Mechanical
6.	Fabrication of Ceramic Green body using Micro Stereo Lithography process	N.Balashanmugam	6 months	Mechanical
7.	Surface Area Multiplication by Femto Second Laser Ablation	V.A.P.Sarma	8 months	Mechanical
8.	Fabrication of Micro fluidic channel by femto second laser	V.A.P.Sarma	8 months	Mechanical
9.	Nano hole fabrication by Combined Focussed Ion beam and deposition process	N.Balashanmugam	8 months	Mechanical
10.	Study of residual stress in Hard Turning of Chrome plates surfaces	N.Balashanmugam	8 months	Mechanical
11.	Machinability study on Chrome plated surface- Comparison of Cermet and CBN Inserts in Hard Turning	N.Balashanmugam	8 months	Mechanical
12.	Characterization of LASER dressed CBN abrasive Wheels by Using SEM	M.Chellamalai	8 months	Mechanical
13.	Investigation of CNT growth on ceramic substrate by Using PECVD system	M.Chellamalai	8 months	Mechanical
14.	Studies on LASER dressed superabrasive grinding wheels by using fiber laser.	M.Chellamalai	8 months	Mechanical
15.	Tool geometry study in micro Milling	M.Chellamalai	8 months	Mechanical

16.	Analysis of CBN insert wear by machining chrome plated surface in hard turning machine	M.Chellamalai	8 months	Mechanical
17.	Investigation of machining accuracy and quality by using femto second Laser micro machining.	M.Chellamalai	8 months	Mechanical
18.	Investigation of different cutting insert coating surfaces by using nano indentation method	M.Chellamalai	8 months	Mechanical
19.	Nano pattern generation using AFM	VAPSarma	6 months	Mechanical
20.	Manufacture of Pitch standards for calibration of Nano Metrology Instruments	VAPSarma	6 months	Mechanical
21.	Establishment of Traceability of Atomic Force Microscope	VAPSarma	3 months	Mechanical
22.	Development of a LVDT based Measuring system for long cylindrical parts	VAPSarma	6 months	Electronics & Instrumentation
23.	Establishment of ductile-brittle transition in brittle materials	VAPSarma	3 months	Mechanical/ Material Science
24.	Establishment of critical depth of cut for Silicon	VAPSarma	6 months	Mechanical/ Material Science
25.	Development of a Micro controller based hardware design for acquiring and analysing the high frequency vibration signals.	N Kusuma	8 months	Electronics/ Instrumentation
26.	Development of SCADA based HMI software and integrating with PLC of Abrasive flow finishing machine.	N Kusuma	8 months	Electronics/ Instrumentation
27.	Design, analysis and simulation of MEMS/NEMS Accelerometer for Machine condition monitoring of CNC machines	N Kusuma	8 months	Electronics/ Instrumentation
28.	**Design, analysis and simulation of** **MEMS/NEMS Temperature sensor for** **Online Spindle growth.**	N Kusuma	8 months	Electronics/ Instrumentation

29.	Design, analysis and simulation of MEMS/NEMS Force Sensor required for Anti Collision testing in machine tools	N Kusuma	8 months	Electronics/ Instrumentation
30.	Investigation on Characterisation methods involved in MEMS/NEMS Sensors for machine tool application.	N Kusuma	3 months	Electronics/ Instrumentation
31.	Investigation on Packaging methods involved in MEMS/NEMS Sensors for machine tool application.	N Kusuma	3 months	Electronics/ Instrumentatin
32.	Nano Structures Machining using Focussed Ion Beam	K.Niranajan reddy	6 months	Mechanical
33.	Surface Characterisation of Nano Finished surfaces	K.Niranjan reddy	6 months	Mechanical
34.	Development of Measurement Methodology for 2D & 3D Measurements by Comparative Methods	K.Niranajan reddy	3 months	Mechanical
35.	Evaluation of Optical Surfaces by Power Spectral Density Functions	K.Niranajan reddy	6 months	Electronics & Instrumentatin
36.	Development of Real Time Thermal Error compensation Algorithm in MatLab / LabView Environment	V.Shanmugaraj	8 Months	Mechanical / Electronics
37.	Design & Development of an Embedded Controller using Micro-Controller	V.Shanmugaraj	8 Months	Electronics / Instrumentation
38.	Design of Hardware for Modifying the Encoder Feedback Pulses for Adaptive Control Applications	V.Shanmugaraj	8 Months	Electronics
39.	Design & Development of MEMS based Strain Sensor	V.Shanmugaraj	8 Months	Electronics / Mechanical

				/ Material Science
40.	Design & Development of Programmable Logic Controller (PLC)	V.Shanmugaraj	8 Months	Electronics (Hardware Design) / Computer Science (Software Development) Research Scholars Electronics / Instrumentation / Control
41.	Development of spindle error analysis system using "Multi probe error separation method" to eliminate master errors	Prakash Vinod	8 Months	Mechanical/ Instrumentation/Electronics
42.	Development of an aspheric part program generation system for an Ultraprecision CNC turning machine	Prakash Vinod	8 Months	Mechanical/ Instrumentation/Electronics
43.	Development of software for On machine gauging & work piece error correction in Ultraprecision turning	Prakash Vinod	8 Months	Mechanical/ Instrumentation/Electronics
44.	Prediction of Surface Roughness in single point diamond turning using	Prakash Vinod	8 Months	Mechanical
45.	Establishment of life cycle and permissible vibration levels of machine tool spindle bearings using vibration monitoring techniques	Prakash Vinod	8 Months	Mechanical
46.	Dynamic and thermal behavior analysis of aerostatic spindles and slides using analytical & simulation techniques	Prakash Vinod	8 Months	Mecahnical

47.	Dynamic and thermal behavior analysis of Hydrostatic spindles and slides using analytical & simulation techniques	Prakash Vinod	8 Months	Mechanical
48.	Investigation on integrating the MEMS Pressure Sensor into machine tools	N.Kusuma	3 months	Electronics / Instrumentation
49.	Development of algorithm for Real time Vibration measurement and analysis using Fast Fourier Transform	N.Kusuma	6 months	Electronics / Instrumentation

1. Study on Temperature Control of Media in Abrasive flow machining

Abrasive Flow Machining is a very precise and economical method of smoothing and polishing internal surfaces and producing controlled radii. The process is particularly useful for difficult to reach internal passages, bends, cavities, and edges. The AFM process uses a specially formulated abrasive laden polymer, hydraulically forced over, or through, areas requiring finishing. The unique properties of the polymer (called Media) permit it to flow through passages and conform to the shape requiring finishing. Normally, parameters like Extrusion Pressure, Number of cycles, Abrasive Concentration, Polymer Type & Concentration, Additives, Abrasive Size and Abrasive Type are varied to get the desired results. In this new method, by varying the temperature of the media visco-elastic property of the material is changed. Analysis would be made on the effect of temperature on the visco-elastic property of media. Study would be to find out whether the same media could be used for roughing and finishing of the surface by changing the visco-elastic properties of the material through temperature control.

Stream: Mechanical

Guide: N.Balashanmugam

2. Static and Dynamic analysis of Hydrostatically Clamped Turning Tool used in High Precision Machining

Vibrations occur from different sources of metal cutting machine tools contribute for poor surface finish on machined parts. In a CNC lathe, vibration to the cutting tool from both the X-axis and Z-axis drives is one of the causes for poor surface finish. This is very important when machining ultra precision components that require high surface finish. The method of hydrostatic clamping which in general gives high stiffness and damping is used in a specially designed tool holder to clamp external turning tool

holder. Hydraulic tool holders for clamping rotating tools for machining centres are available and extensively used in high speed machining centres. Improved surface finish and tool life are being realised with such tool holders. But, applying hydraulic tool holders for external turning is new. Apart from giving high stiffness for clamping, this hydrostatic tool holder dampens vibrations from the cross and longitudinal drives and reduces unwanted movement between work piece and tool. This is used on a CNC lathe for precision turning. A study on static and dynamic behaviour of such hydrostatic tool holder has to be carried out . Tool holder has been designed in such a way that it floats hydraulically. Here hydrostatic bearing principle is used in designing this hydrostatic tool clamp. By hydrostatic bearing generally means any bearing in which the load is transmitted from the supported to the supporting member through a thin film of fluid, i.e. liquid, by virtue of pressure maintained by an external pump. At no point do the solid surfaces make any physical contact. This means that the thin fluid film separating the surfaces is always larger than the height of the surface irregularities. In this application constant supply pressure system is used because of higher stiffness required for clamping the tool holder. Hydraulically clamped tool holder has been used on precision CNC lathe for obtaining nano finish. Experiments need to be conducted and vibration studies including operational deflection shapes are to be made with hydrostatic tool holder and without it.
Stream: Mechanical

Guide: N.Balashanmugam

3. Analysis of Tool wear in Turning by Hydrostatically clamped turning tool

Applying hydraulic tool holders for external turning is a new approach. Apart from giving high stiffness for clamping, this hydrostatic tool holder dampens vibrations from the cross and longitudinal drives and reduces unwanted movement between work piece and tool. This is expected to provide improved tool life apart from surface finish. A study would be conducted to analyze the improvement in tool wear in turning by hydrostatically clamped turning tool.

Stream: Mechanical

Guide: N.Balashanmugam & V.R.Raju

4. Study on Deterministic Surface Roughness generation using micro EDM

It is required to have a higher surface roughness to fix a medium on to a metallic surface. The process has to be deterministic. Through EDM process, BY controlling the parameters like capacitance and voltage, it is possible to modify the surface topography. Modified surface could be useful for improving the adhesiveness. This project would deal with means to achieve different surface roughness values by changing the micro EDM parameters.
Stream: Mechanical

Guide: N.Balashanmugam & V.R.Raju

5. Study of UV laser Spot Size and polymerization of HDDA material in Micro Stereo Lithography (MSL) process

Micro stereo lithography (MSL) is a process of manufacturing physical objects in a layer manner directly from their CAD models without the use of any tools, dies or fixtures. It is a layer by layer complex 3D microstructure realization process. In principle, μSL utilizes focused light spot scanning over the photo curable resin surface and then a light induce photo polymerization occurs, constructing solid micro structures. With focused light spot scanning, a tightly focused laser spot permits micron-scale spatial resolution. It is the most unique feature of this process that liquid UV (Ultra Violet) polymer can be solidified at a pinpoint position in 3D space by optimizing apparatus and focusing condition of the laser beam. This pinpoint exposure enables to make real 3D micro structure without any support parts nor sacrificial layers. It is a mask less technology for fabrication of micro parts in 3D using simple 3D design .

In this project, a study would be made to determine the thickness of the layer, width of the layer for a particular spot size. Scope of the project involves theoretical study and experimentation. Micro Stereo lithography system available in CMTI would be used for the purpose of experimentation.

Stream: Mechanical/Material Science

Guide: N.Balashanmugam

6. Fabrication of Ceramic Green body using Micro Stereo Lithography process

Micro stereo lithography (MSL) is a process of manufacturing physical objects in a layer manner directly from their CAD models without the use of any tools, dies or fixtures. It is a layer by layer complex 3D microstructure realization process. In principle, μSL utilizes focused light spot scanning over the photo curable resin surface and then a light induce photo polymerization occurs, constructing solid micro structures. With focused light spot scanning, a tightly focused laser spot permits micron-scale spatial resolution.

In this project Fabrication of ceramic green bodies with complex geometry shapes would be accomplished by mixing UV curable resin with fine powders. A complex 3D object is decomposed into general 2D objects or slices. The slices are physically realized by focusing laser beam on a UV curable region. Polymerization happens when layer beam is focused on the system. Fabricated part would characterized for physical properties and dimensions with respect to the solid CAD model.

Stream: Mechanical/Material Science

Guide: N.Balashanmugam & K.Ankit

7. Surface Area Multiplication by Femto Second Laser Ablation

Femto second laser materials processing is a versatile tool for precise machining of micro- and nano-scale features, as there is little or no damage from generation of stress waves, thermal conduction, or melting. Direct laser writing of patterns enables rapid prototyping without photo-masks, molds, and post-processing. Some important applications of ultrafast lasers include multiplication of surface area . Lasermicro/ nano-structuring are of interest for solar devices.

In this project, using femto second laser available in CMTI, a study would be made to increase the surface area by surface structuring. Optical profiler and FESEM available in CMTI would be used for topography analysis.

Stream: Mechanical/Material Science

Guide: V.A. P.Sarma

8. Fabrication of Micro fluidic channel by femto second laser

Femto second laser materials processing is a versatile tool for precise machining of micro-andnano-scale features, as there is little or no damage from generation of stress waves, thermal conduction, or melting. Fabrication of 3D prototype structures using traditional MEMS fabrication process is tedious, time consuming and expensive. Direct laser writing of patterns enables rapid prototyping without photo-masks, molds, and post-processing. Some important applications of ultrafast lasers include fabrication of fluidic devices which are of interest for lab-on-a-chip devices for biotechnology applications.

In this project, micro fludic channel for mixing two fluids would be disgned and fabricated using femto second laser system available in CMTI. FESEM equipment available in CMTI would be used for characterising the micro fluidic channels.

Stream: Mechanical

Guide: V.A.P.Sarma

9. Nano hole fabrication by Combined Focussed Ion beam and deposition process

Focussed Ion beam milling is a nano level machining process. In this process, gallium ion beam is used to remove the material by sputtering. It is a material independent process. Normally feature sizes around 100nm are machined using ion beam. It is difficult to fabricate feature sizes less than 50nm. There are many applicationsin nano technology, where feature sizes less than 50nm are required. Possibility exists to fabricate nano hole of size less than 50nm using focused ion beam machining and deposition process. In this project, dual beam system

(FIB+FESEM) would be used for ion beam milling and as well fro deposition. The same equipment would used for characterization.

Stream: Mechanical

Guide: N.Balashanmugam & Ankit.K

10. Study on Residual stress in Hard Turned Chrome plated parts

Chrome plated surfaces are normally ground. In this proposal. Hard turning of chrome plated surface would be carried out on hardened part using CBN insert. Residual stress induced due to machining would be analysed using XRD and its effect in various applications would be analysed.

Stream: Mechanical

Guide: N.Balashanmugam & Ankit.K

11. Machinability study of Chrome plated surface- Comparison of Cermet and CBN Inserts in Hard Turning

Chrome plated surfaces are normally ground. Hard turning of chrome plated surface would be attempted using Cermet & CBN insert. Scope of the project involves theoretical study, modeling the process, simulation and experimentation. Hard Turning facility available would used the purpose of experimentation.

Stream: Mechanical

Guide: N.Balashanmugam

12. Characterization of LASER dressed CBN abrasive Wheels by Using AFM & SEM

Dressing of CBN abrasive grinding wheels by conventional method is very difficult but by using Laser source it can be done very easily. After dressing the wheel by using LASER source, the topography of the surface is studied by using Atomic Force Microscope & Scanning Electron Microscope. The details of dressed surface and images are analyzed in this project.
Stream: Mechanical

Guide: M.Chellamalai

13. Investigation of CNT growth on ceramic substrate by Using PECVD system

Ceramic is normally very brittle and low toughness. This property is improved by adding CNT in the ceramic composite matrix. This project involves the preparation of CNT growth on ceramic substrate by using PECVD system, and analysis of the mechanical properties like toughness, wear resistance etc. by using nano indentation method and scratch test etc.

Stream: Mechanical

Guide: M.Chellamalai

14. Studies on LASER dressed superabrasive grinding wheels by using fiber laser.

This project involves the design and development of a laser dressing device to use on a ultra precision cylindrical grinding machine. High power fiber laser will be used for truing and dressing of CBN grinding wheels as an alternative to traditional way of dressing. Laser dressing offers a technique in which a beam is used as the non-contact thermal dressing tool to dress super abrasive wheels. Also compare the surface topography with conventional dressing method.

Stream: Mechanical

Guide: M.Chellamalai

15. Tool geometry study in micro milling:

Micromachining becomes more and more important in fabricating micro parts. Unpredictable tool life and premature tool failure present a serious concern in micromachining. To further understanding the process, a systematic study of various tool geometry is required. Tool failure modes and the life of different geometry has to be studied. This project involves the study of different tool geometry end mills like two flute, D-type and triangle based. If possible FEM analysis of tool geometry with actual experimental data will be compared.

Stream: Mechanical

Guide: M.Chellamalai

16. Analysis of CBN insert wear by machining chrome plated surface in hard turning machine

Tool wear is one of the main issues to maintain the final accuracy of the finished parts. Particularly in hard turning the wear rate is more compared to normal machining due to high cutting velocity. This project involves the study of tool wear of CBN inserts at different cutting speeds and the effect of chrome plated surface.The tool wear is inspected by using profile projector and the SEM.

Stream: Mechanical

Guide: M.Chellamalai

17. Investigation of machining accuracy and quality by using femto second Laser micro machining:

Unlike the CO_2 or Nd:YAG lasers, Excimer and Femto Second lasers, on the contrary, offer high-precision machining without the formation of a re-solidified layer and a heat-affected zone. There are two types of methods that are based on material removal by ablation. One uses a power source that emits a beam with very high quantum energy. If the energy exceeds the binding energy among atoms of the work piece, each molecule can be decomposed directly into atoms and removed from the work piece. The other method uses an energy beam of which incident power density on the work piece is extremely high. Such a high power enables the removal of the work piece by vaporisation, skipping the phase of melting. This project involves the study of femto second laser machined features accuracy and heat affected zone etc.

Stream: Mechanical

Guide: M.Chellamalai

18. Investigation of different cutting insert coating surfaces by using nano indentation method

The quality of insert coating like TiN, TiC etc depends on the surface hardness and adhesion of the surface layer with base material WC. The properties of the coating layer

is investigated by using nano indentation method and the experimental results were compared with actual performance of the insert tool life.
Stream: Mechanical

Guide: M.Chellamalai

19. Nano pattern generation using AFM

Hard brittle materials like Glass, Silicon, ceramics and other crystalline materials find applications in MEMS and other nano-technology applications. To produce meso, micro and nano scale devices feature like lines, grooves etc are to be manufactured on the surfaces of these materials. In addition to established processes like deposition and lithography method one can use an imprinting process, which makes use of the indentation method. The tool required for such processes can be produced either by Focussed Ion Beam machining or by using an AFM tip. In this project a tool having pattern for imprinting method will be developed using an AFM.

Stream: Mechanical

Guide: VAP Sarma

20. Manufacture of Pitch standards for Calibration of Nano Metrology Instruments

Calibration is essential before any measuring equipment is used for measurement. This is true in case of nano-metrology also. The standards used for nano-metrology instruments like Atomic Force Microscope, Interferometric Microscopes etc comprises of lines marked at specified intervals. Such standards are manufactured by companies like VLSI, etc. in advanced countries. The project aims at development of these standards at CMTI using Laser Micro Machining System.

Stream: Mechanical

Guide: VAP Sarma

21. Establishment Traceability of Atomic Force Microscope

Calibration is essential before any measuring equipment is used for measurement. This is true in case of nano-metrology also. The standards used for nano-metrology instruments like Atomic Force Microscope, comprises of lines marked at specified

intervals. Calibration facility is not available for such standards in our country for such standards. The project aims at establishing the traceability of these standards using inter-laboratory comparison so that these nano-metrology equipment can be confidently employed for measurements of nano components.

Stream: Mechanical

Guide: VAP Sarma

22. Development of a LVDT Based Measuring System for Long Cylindrical Parts.

To develop a precision measuring system for the measurement of diameter and geometrical parameters like Roundness, Straightness and Cylindricity for long cylindrical parts. The project involves conceptual design, design of actual measuring system including mounting arrangement, development of data evaluation software for calculation and 3D Representation of the measured results for the above listed parameters.

Stream: Mechanical /Instrumentation

Guide: VAP Sarma

23. Establishment of ductile – brittle transition in brittle materials

It is known that when classically brittle materials like glass, silicon, other crystalline materials and ceramics are machined using conventional machines methods chipping of surfaces takes place. It has been established that when these materials are machined by a sharp diamond tool using sub-micrometer depth of cuts on ultra precision machines, ductile chips are produced similar to that in machining of ductile materials like aluminium. This is due to a phase transformation that takes place because of the pressure created by the cutting force during machining. The project aims to understand and establish the brittle ductile transition phenomenon in brittle materials using indentation experiments and scratch tests.

Stream: Mechanical/Material Science
Guide: VAP Sarma

24. Establishment of critical depth of cut for silicon

It is known that when classically brittle materials like glass, silicon, other crystalline materials and ceramics are machined using conventional machines methods chipping of surfaces takes

place. It has been established that when these materials are machined by a sharp diamond tool using sub-micrometer depth of cuts on ultra precision machines, ductile chips are produced similar to that in machining of ductile materials like aluminium. The project aims at establishing critical depth of cut for brittle ductile transition in brittle materials using indentation experiments and scratch tests. These results have to be compared with other experimental data available and also with the established theoretical formulae available.

Stream: Mechanical/Material Science
Guide: VAP Sarma

25. Development of a Micro controller based hardware design for acquiring and analyzing the high frequency vibration signal

This project involves design and development of Micro Controller based hardware device. It comprises a Micro controller, Address decoder, Analog to Digital Converters and Digital to Analog Converters and some high frequency switching circuitry. Micro controller should be programmed using Assembly language / C language with cross compiler, to acquire and analyse the high frequency Vibration signal using MEMS sensors with Signal Conditioner. This hardware device is used for real time measurement of vibration in machine tools for adaptive control.

Stream: Electronics/Instrumentation

Guide: N.Kusuma

26. Development of SCADA based HMI software and integrating with PLC of Abrasive flow finishing machine.

Abrasive flow finish machining is a very precise and economical method of smoothing and polishing internal surfaces and producing controlled radii. The aim is to develop a electrical controller for this abrasive flow finishing machine, which is PLC based with a Human Machine Interface having a keyboard and a monitor. This project involves the development of SCADA based HMI software to control the flow of media using hydraulic cylinders, controlling the movement of cylinder pistons for number of cycles at different pressure range. This involves development of HMI software using “SoftTouch” software and integrating with “Messung” PLC. PLC programs to be written using ”Codesys”.software.

Stream: Electronics/Instrumentation

Guide: N.Kusuma

27. Design, analysis and simulation of MEMS/NEMS Accelerometer for Machine condition monitoring of CNC machines

MEMS Accelerometer is of Comb drive Capacitive type. It is composed of movable proof mass with movable and fixed plates attached through a mechanical suspension system to a reference frame. The movable plates and fixed outer plates repesents capacitors, The deflection of proof mass is measured using the capacitance difference, which is further converted into output voltage or current using electronics.

This mini project gives in-depth knowledge on various processes involved in designing, fabrication and packaging of MEMS Accelerometer.
This project involves designing the mechanical part, integrate with the electronics signal conditioning, and perform Analysis, Simulation and also virtually fabricate the MEMS Accelerometer using MEMS Design and simulation software CoventorWare. These accelerometers can be used for machine condition monitoring of CNC machines.
Stream: Electronics/Instrumentation

Guide: N.Kusuma

28. Design, analysis and simulation of MEMS/NEMS Temperature sensor for Online Spindle growth measurement in machine tools

MEMS Temperature sensor is a contact type Platinum Temperature Detector (PTR), which is having positive temperature co-efficient and the temperature has to be measured at the surface of the platinum. Whenever there is a change in temperature there is a change in resistance of the platinum, which is further converted into output voltage or current using electroincs.

This mini project gives in-depth knowledge on various processes involved in designing, fabrication and packaging of MEMS Temperature sensor. This project involves designing the mechanical part, integrate with the electronics signal conditioning, and perform Analysis, Simulation and also virtually fabricate the MEMS Temperature sensor using MEMS design and simulation software CoventorWare. These Temperature sensors can be used for Online Measurement of spindle growth in machine tools.
Stream: Electronics/Instrumentation

Guide: N.Kusuma

29. **Design, analysis and simulation of MEMS/NEMS Force Sensor required for Anti Collision testing in Machine Tools**

MEMS/NEMS Force sensor is of Cantilever type, when ever a force is applied on a cantilever, it bends. The surface on which the Cantilever is mounted and the Cantilever itself form a capacitance, due to this bending of the cantilever there is defection or change in displacement. Here the change in displacement is proportional to change in capacitance and capacitcane is further converted to voltage with the help of electronics. Hence the force is measured as output voltage. This mini project gives in-depth knowledge on various processes involved in

designing, fabrication and packaging of MEMS Force sensor. This project involves designing the mechanical part, integrate with the electronics signal conditioning, and perform Analysis, Simulation and also virtually fabricate the MEMS Force sensor using MEMS design and simulation software CoventorWare. These Force sensors can be used for Anti collision testing in machine tools.

Stream: Electronics/Instrumentation

Guide: N.Kusuma

30. Investigation on Characterisation methods involved in MEMS/NEMS Sensors for machine tool application.

MEMS (Micro-ElectroMechanical Systems) is a key technology for manufacturing in machine tool industries. There are various MEMS devices designed and fabricated and also there are many researches going on in this field. Currently we find many MEMS devices available in the market.

Characterization of these devices can be done to find the mechanical, electrical, thermo mechanical characteristics of these MEMS/NMES devices and also material properties by using some MEMS characterization equipments.

Characterization of the newly designed, fabricated MEMS/NEMS devices can also be done before and after packaging.

This mini project investigates on various methods involved during characterization of MEMS/NMEMS sensors used in machine tool application

Stream: Electronics/Instrumentation

Guide: N.Kusuma

31. Investigation on Packaging methods involved in MEMS/NEMS Sensors for machine tool application.

MEMS/NEMS device packaging means connection from chip level to outside world. There are various levels of packaging. Packaging protects the MEMS/NEMS devices from working environment, i.e, electrical isolation from electrolytes and moistures, mechanical protection to ensure structural integrity, optical and thermal protection to prevent undesired effects on performance, chemical isolation from harsh chemical environment.

This mini project emphasis on various types and methods involved during packaging of MEMS/NMEMS Sensors used in machine tool application

Stream: Electronics/Instrumentation

Guide: N.Kusuma

32. Nano Structures Machining using Focussed Ion Beam

Focuussed Ion Beam machining has the capability in machining nanometer range and widely used in Micro and Nano Machining. Creation of Nano structures/ patterning is one of the Nano Technology Applications. The purpose of this project is to study the different structure/ pattern requirement, machine the structures using FIB system and optimisation of FIB Milling parameters for realisation of structures machining.
Stream: Mechanical

Guide: K.Niranjan Reddy

33. Surface Characterisation of Nano Finished surfaces

Surface finish is one of the important parameter of Nano finish surfaces like Optical parts, Diamond turned parts, Ultra precision parts and Micro components which are having the surface finish in the order of few nano meters. Characterisation and optimisation of these surfaces is one of the challenging tasks by using non contact methods. The aim of this project is to establish the parameters for surface finish measurement for nano surfaces using Non contact method like AFM, Optical profiler.

Stream: Mechanical

Guide: K.Niranjan Reddy

34. Development of Measurement Methodology for 2D & 3D Measurements by Comparative Methods

To-days scenario of precision measurements is such that the component tolerances are in the same order of the measuring uncertainty of the measuring equipment. This requires the improvisation of measurement system that can be achieved by using various artifacts while making the measurements on the components. Co-ordinate Measuring Machine (CMM) is a total Measuring system with the capability to move a probing system and to determine spatial coordinates on a work piece surface, which can be further processed, to arrive at the required parameters. CMMs can measure dimensions of 1D (Length), 2D (Ring Gauge Diameter) & 3D (Sphere Diameter), geometrical parameters, positional parameters, known and unknown curves and measurement of Gears. The purpose of this project is to demonstrate the improvisation of measurement accuracies in precision measurements using CMM by comparison method, with the usage of various artifacts like, Setting Ring/ Plug Gauges for 2D Measurements and Master Spheres for 3D measurements.

Stream: Mechanical

Guide: K.Niranjan Reddy

35. Evaluation of Optical Surfaces by Power Spectral Density Functions

The most popular parameter in characterisation of the surfaces, Roughness Average (Ra), Root Mean square Average (Rq), which represents the surface around its mean value. However this statistical description, though simple and reliable, makes no distinction between peaks and valleys and does not account for the lateral distribution surface feature. A more complete description is provided by the power spectral density (PSD) of the surface topography. For optical surfaces PSD function is especially important and represents best way to describe the surface quality as it is related with the amount angular reflections of scattered light. The purpose of this project is to establish the methods/ parameters for evaluation of optical surfaces by PSD functions.
Stream: Electronics/Instrumentaion

Guide: K.Niranjan Reddy

36. Development of Real Time Thermal Error compensation Algorithm in MatLab / LabView Environment

A Real Time Thermal Error compensation module to be developed using MatLab / LabView and this module has to be integrated with an Open Architecture based Computerised Numerical Controller (CNC). Thermal Error algorithm may be built using Neural Network / Neural Fuzzy Theory and so on. An executable

Stream: Mechanical / Electronics

Guide:V.Shanmugaraj

37. Design & Development of an Embedded Controller using Micro-Controller

A Micro-Controller based Embedded controller to be designed to compute Thermal error basically meant for Machine Tool Application. The controller will be interfaced to Temperature sensors on one end and Computerised Numerical Controller (CNC) on the other end. This controller will have an interface to connect about 16 Temperature sensors.

Stream: Electronics / Instrumentation

Guide: V.Shanmugaraj

38. Design of Hardware for Modifying the Encoder Feedback Pulses for Adaptive Control Applications

This Hardware module could be an Intelligent / Discrete components based design. A few encoder pulses have to be either removed from the train of pulses or Added to it. The module developed will be used as Adaptive control module wherein it will alter the feedback pulses. The number of pulses to be added or removed will be based on thermal error compensation module.

Stream: Electronics

Guide: V.Shanmugaraj

39. Design & Development of MEMS based Strain Sensor

The sensor has to be designed using Coventorware MEMS Design and Simulation software. This sensor will be used for measuring the Machine Tool slide Thermal deformation as well as the Spindle growth etc.

Stream: Electronics / Mechanical / Material Science

Guide: V.Shanmugaraj

40. Design & Development of Programmable Logic Controller (PLC)

The PLC will be built based on Intel's 8051 or Atmel's XMega series Micro-Controller. "Embedded Software" for the Execution of PLC Instructions and "Application Development software" for editing the PLC Instructions in the form of "Ladder / Statement List / Functional Flow Chart and Higher Level Languages like "C" program" have to be developed. The PLC software will comply with IEC-61131 standard.

Stream**:** Electronics (Hardware Design) / Computer Science (Software Development)

Guide: V.Shanmugaraj

41. Development of spindle error analysis system using "Multi probe error separation method" to eliminate master errors

The spindle error of a high precision spindle is measured using a non-contact displacement probe over a master cylinder or sphere mounted on the spindle. The measured spindle error is highly influenced by the form error of master for high precision spindles. The algorithm based on multi probe gauging, helps to eliminate the master error.

The aim of the project is to develop algorithm & software for data acquisition, error separation, error analysis and reporting using multi-probe method to eliminate master errors.

Stream: Mechanical /Electronics/Instrumentation

Guide: Prakash Vinod

42. Development of an aspheric part program generation system for an Ultraprecision CNC turning machine

The system should generate CNC part programs from the defined (equation) optical surface. The system should be capable to generate part program to machine spherical, aspheric, point-to-point, toric & polynomial surface of revolution. The system should work with a open architecture motion controller available at CMTI.

Development of a software for integration of a optical tool setting system to a an open architecture motion controller

The work involves development of a windows based tool setting software for automatic measurement of tool radius, tool inspection, calculation of tool centerline position and updating of tool-offset table in the Motion controller.
Stream: Mechanical /Electronics/Instrumentation
Guide: Prakash Vinod

43. Development of software for On machine gauging & work piece error correction in Ultraprecision turning

The software developed should use the measurement data obtained from a on machine gauging system, work in conjunction with the tool path generation software to automatically correct the original tool path program for the measured form errors of the workpieces. The software will be developed to work with an open architecture motion controller.

Stream: Mechanical /Electronics/Instrumentation

Guide: Prakash Vinod

44. Prediction of Surface Roughness in single point diamond turning using Matlab

In single point diamond turning, the quality of surface finish is an important requirement for work pieces. The machine dynamics & the cutting parameters plays important role for controlling the required surface quality. The focus of the present study is to develop an on line process model to predict the surface roughness in the SPDT process. The input to the model is the data from sensors (Vibration, Cutting forces & acoustic emission) mounted on the machine for on line process monitoring and the cutting parameters. The output is the predicted surface roughness. The process model to be developed using Matlab.

Stream: Mechanical

Guide: Prakash Vinod

45. Establishment of life cycle and permissible vibration levels of machine tool spindle bearings using vibration monitoring techniques

At present, there are no standards available for determining the acceptable vibration limits (for single valued vibration parameters such as overall vibration severity level, RMS Velocity in different frequency bands, crest factor, etc) for various types of machine tool spindles. However, there are some standards like ISO 10816 and Canadian specifications that gives indication of rotating machinery health based on overall vibration but these standards are applicable for general purpose machines like Pumps, Compressors, Generators, Motors, etc.

Hence permissible vibration levels needs to be established for various machine tool spindles indicating the status of system to be good, alarming and bad.

CMTI has been performing condition monitoring by vibration monitoring at various industry (mainly having large quantity of machine tool) from past 20 years and has large database of vibration data, analysis reports and case studies for various types of machine tool.

The aim of the project is to study the condition monitoring databases/reports and identify trend/pattern of vibration level related to a healthy and unhealthy machine tool spindle and establish :

- A standard vibration level for various types of machine tool spindles
- Damage factors w.r.t. various single valued parameters to indicate unhealthy condition.
- Establish life cycle of various spindle bearing by study of vibration level & patterns

Stream: Mechanical
Guide: Prakash Vinod

46. Dynamic and thermal behavior analysis of aerostatic spindles and slides using analytical & simulation techniques

The machining accuracy of an ultraprecision machine tool mainly depends on the dynamic and thermal behavior of the critical machine elements like spindle & slide. Aerostatic bearing for spindle & slides are most commonly used in Ultraprecision machining system due to it's characteristics like high accuracy and moderate load carrying capacity. Apart from dynamic behaviour, the thermal phenomena is another major contributor to the machining errors. The minimization of thermal and dynamic errors has an important bearing on the effectiveness of machining processes.

In this project, the dynamic and thermal behavior of an aerostatic spindle and slide is to be analysed using finite element packages meant for analysis and simulation.

Stream: Mechanical /Electronics/Instrumentation

Guide: Prakash Vinod

47. Dynamic and thermal behavior analysis of Hydrostatic spindles and slides using analytical & simulation techniques

The machining accuracy of an ultraprecision machine tool mainly depends on the dynamic and thermal behavior of the critical machine elements like spindle & slide. Hydrostatic spindles and slides are used in precision machines for high load carrying capacity and high precision rotary and linear motion. However, the hydrostatic fluid generates heat in the machine elements due to shearing of fluid layers in motion. This heating effect causes thermal deformation of the machine elements leading to machining errors. The influence of thermal phenomena on th precision of machine tools can be reduced through their optimum design which assumes minimization of heat sources and thermal displacements.

The aim of the project is to conduct a detailed study on the dynamic and thermal behavior of the a hydrostatic spindles and slide. Finite element packages like ANSYS and HYPERWORKS should be used for analysis of dynamic & thermal behaviour of hydrostatic spindles and slides.

Stream: Mechanical

Guide: Prakash Vinod

48. Investigation on integrating the MEMS Pressure Sensor into machine tools

In CNC machines such a Lathe, milling machine etc, there are many pressure sensors, especially in hydraulics system, these are normal size pressure sensors. However these pressure sensors could be replaced by MEMS pressure sensors which are miniature in size, low cost, high volume production, have low power consumption. This project involves identification of such normal Pressure sensor/ switches /gauges existing in CNC Lathe and Milling machine, study about its specifications and replacing with MEMS Pressure sensor of similar specifications, and investigation on functionality of CNC machines (lathe/milling machine) with MEMS pressure sensors compare to normal size pressure sensors.

Stream: Electronics and Instrumentation

Guide: N.Kusuma

49. **Development of algorithm for Real time Vibration measurement and analysis using Fast Fourier Transform.**

This project involves study of vibration signature and various methods used in vibration measurement and analysis, development of algorithm by using MatLab / Labview software or C++ Language, acquiring the real time vibration data at machine tool area using data acquisition system, conversion of acquired time domain data into frequency domain using Fast Fourier Transform, calculation of vibration levels and creation of Alarms and Error messages when the vibration is too high.

Stream: Electronics and Instrumentation

Guide: N.Kusuma