

MUKUNDA MADHAVA NATH

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PERSONAL STATEMENT

I am looking forward to pursue research in the broad area of multiphysics engineering with focus on computational science, device design and micro/nano-engineering.

EDUCATION

Master of Design (MDes), Product Design and Engineering, July 2011 - July 2013
Centre for Product Design and Manufacturing(CPDM).
Indian Institute of Science (IISc) Bangalore, India
GPA 6.4/8.0

Thesis - Design, Fabrication, and Testing of a Novel and Cost-Effective Soil Moisture Sensor Meter for Farming Applications in India.

Advisor - Dr. G. K. Ananthasuresh, Professor, Dept of Mechanical Engineering, IISc Bangalore

Bachelor of Technology(BTech), Mechanical Engineering, July 2006 - June 2010
Department of Mechanical Engineering.
National Institute of Technology (NIT) Silchar, India.
GPA 6.4/8.0

Thesis - Design and analysis of thermal actuators for MEMS applications.

Advisor - Dr. P. K. Patowari, Associate Professor, Dept of Mechanical Engineering, NIT Silchar.

PUBLICATIONS/PATENTS

1. **Mukunda Madhava Nath**, Ami Sampat, G. K. Ananthasuresh. **Design of a Cost-effective Soil Moisture Sensor for Indian Farming Community**. *Manuscript under preparation*.
2. **Mukunda Madhava Nath**, Lalit Singhal, Dibakar Sen. **Design and Prototyping of a Hexapod Dual Drive Mechanical Walking Vehicle**. *Manuscript under preparation*.
3. **Mukunda Madhava Nath**, Nitin Gupta, Dibakar Sen. **Design of an Ergonomic Bicycle Seat**. In proceedings of *International Ergonomics Conference - Humanizing Work and Work Environment*, December 2014, IIT Guwahati, Assam, India.
4. Dibakar Sen, **Mukunda Madhava Nath**, Nitin Gupta. **A bicycle seat assembly**. *Indian patent application 2105/CHE/2013*. Patent pending.
5. P. K. Patowari, **M. M. Nath**, A. S. Bharali, J. Gogoi, C. K. Singh. **Comparative Study of Different Micro-Thermal Actuators for Micro-Electro-Mechanical-System Application**. *Journal of Advanced Manufacturing Systems (JAMS)*, Volume 11, Issue 1(2012) pp. 17-26, January 1, 2012.
6. P. K. Patowari, **M. M. Nath**, A. S. Bharali, J. Gogoi, C. K. Singh. **Comparative Study of Different Micro-Thermal Actuators for MEMS Application**. In Proceedings of the *3rd International and 24th All India Manufacturing Technology, Design and Research (AIMTDR) Conference*, December 2010, Visakhapatnam, India.
7. P. K. Patowari, **M. M. Nath**, A. S. Bharali, J. Gogoi, C. K. Singh. **Analysis of a Monometallic Two Arm Horizontal Thermal Actuator for MEMS**. In Proceedings of the *2nd International Conference on Mechanical and Electronics Engineering (ICMEE)*, August 2010, Japan.

COURSEWORK

Finite Element Analysis for Materials Engineers, Advanced Micro-Nano Systems, Mechanism Design, Computer Aided Design, Creative Engineering Design.

WORK EXPERIENCE

General Motors Technical Center India

Safety Crashworthiness CAE, Bangalore, India

Simulation Engineer
August 2013 - Present

- Nonlinear explicit dynamics simulations intensive of contact and material nonlinearity in LS-DYNA.
- CAE Analysis of full-vehicle frontal, rear and side loadcases in USNCAP, China NCAP.
- Structural and occupant simulation for full vehicle models.
- Correlation of CAE model to physical test results.
- Development of counter measures to meet performance target values.
- Professional working efficiency and capability in LS-DYNA, Primer, and Hyperworks Package.

Indian Institute of Science Bangalore

Computational Nano-Engineering Group, under Dr. Ananthasuresh

Project Assistant
August 2010 - June 2011

- Benchmarking of an FEA package developed in IISc (HyFEM) to commercial packages.
- Finite element simulation of micro compliant mechanisms.

PROJECTS

Design and fabrication of a cost effective novel soil moisture sensor for Indian farming community.

Guided by Dr. G. K. Ananthasuresh

Aug 2012 - June 2014

This is the dissertation project for the degree of MDes from CPDM, IISc in a team of two. The final prototype is appreciated by many ground users, agricultural scientists and funding agencies alike.

We designed a soil moisture sensor using a absorbent (Sodium Polyacrylate) which expands by absorbing water from the soil and provide an input force to a compliant mechanism designed by us. The compliant mechanism, in turn, gives an output in terms of displacement in another point that is correlated to an analog scale.

- Cost of final product less than \$10.
- Portable, robust, easy to operate and calibrate.
- Response time less than 30 minutes.
- Accuracy is ± 3 percent.
- No electrical power requirement.
- Independent of type of soil and crop.

Skills/Learning: Compliant mechanism design using kinetoelastic maps, rapid prototyping, embodiment design, product development from scratch.

Design for manufacturing and full scale prototyping of a six-legged mechanical walking vehicle.

Guided by Dr. Dibakar Sen

May 2012 - Present

This project involves designing and prototyping of a six legged mechanical dual drive walking vehicle. The vehicle has the unique capability of turning and control with purely mechanical elements.

The basic elements, the leg, is designed from Hoecken's straight line mechanism using the concept of cognates. The legs are coupled using a particular gait for moving forward.

Skills/Learning: Lathe machining, design for manufacturing, mechanism design, simulation in MSC Adams

Design of an ergonomic bicycle seat for common users.

Guided by Dr. Dibakar Sen

Aug 2011 - Dec 2011

This project culminated in a patented (Indian patent application pending, 2105/CHE/2013) prototype of an ergonomic bicycle seat that solves the mutually dependent problems: perineum pressure, suspension design and perceived instability in no-nosed seats.

A poorly designed seat does not distribute body weight or reduce pressure effectively over the perineum and thus increase the risk of seat discomfort or injury, which seems to be a common occurrence among cyclists. The aforesaid problems are interdependent and previous effort has been to solve a single one without any regard to the effect of the solution to other problems. In this project, we are providing a solution that is based on a holistic solution for all the problems.

Skills/Learning: Ergonomic design, product design, mechanical design.

Design and prototyping of a link for snake like hyper-redundant endoscopy device.

Guided by Dr. B. Gurumoorthy and Dr. Asitava Ghosal

Aug 2012 - Dec 2012

This is a course project for the course Computer Aided Product Design. This project is aimed at designing a snake like robot to be used for endoscopy and actuated by shape memory alloy (SMA) wires. The final design incorporated links connected by a ball joint in the form of contacting surfaces and relatively actuated by SMA wires. The unique capability of the product is the better control exerted over the entire length of the endoscope as compared to a conventional endoscope.

Skills/Learning: Working principles of SMA wire and actuation mechanisms, mechanism design.

Design and analysis of two arm thermal actuators for MEMS applications.

Guided by Dr. P. K. Patowari

Aug 2009 - June 2010

This is the dissertation project for undergraduation in mechanical engineering from National Institute of Technology Silchar.

This project considers a two arm monometallic horizontal thermal actuator as a basic model (Model I) for design and analysis. In this process, the actuator modelling is first done and then the analysis for the deflection, stress developed, temperature attained by the actuator is carried out by applying different voltages. Three materials, namely Silicon, Poly-Silicon and Titanium, are considered for analysis. The three materials show different variations at different applied voltages. Then two other models, Model II and Model III are introduced. Model II has arms with varying lengths and Model III has the same geometry as the basic model but is bimetallic. This project aims at finding the suitability of the materials and configuration of thermal actuators for their applications with respect to applied voltage.

Model I, using Poly-Si, is again analyzed for varying lengths and cross sections of the arms. Then for calculating the output force a theoretical method is proposed using the analogy of point load deflection of a cantilever. The relation between output force and deflection of the actuator is analyzed. Next, using the basic model an array is modelled and analyzed for deflection for number of actuators in the array and applied voltage. In terms of application, a mechanism for rotation of a micro ratchet is proposed using two actuators of the basic model in place of a V-beam actuator.

Skills/Learning: Exposure to MEMS and multiphysics systems, simulation of multiphysics systems in Comsol, technical writing.

SOFTWARE SKILLS

Simulation Packages: LS DYNA, Ansys, Comsol, Abaqus.

Pre-Processing: Hypermesh, Primer, LS Prepost.

Programming: Python, MATLAB, C++.

Presentation/Documentation: MS Office, \LaTeX , Beamer.

SCORES

GRE (appeared 28th October, 2014) Score - 325 (Verbal-165, Quant-160), AWA - 3.5

TOEFL (appeared 9th November, 2014) Score - 110 (Reading 29, Listening 28, Speaking 23, Writing 30)

Graduate Aptitude Test in Engineering (**GATE**), Paper in Mechanical Engineering (2011) - Scored above 99 percentile

HONORS/ACHIEVEMENTS

- Design for Six Sigma (DFSS) *GreenBelt*, General Motors University
- Graduate Scholarship from MHRD, Government of India for pursuing masters' degree.
- Certificate of Proficiency from the Government of Assam for securing state rank of 24 and 32 in class X and XII board examinations respectively.

PERSONAL DETAILS

Male. Indian Citizen. *DoB* - 31st December, 1988

Present Address:

551/36, Muthukurappa Layout

Opp. HDFC Bank, Mahadevpura Post

Bangalore, Karnataka, India - 560048

REFERENCES

- **Dr. Dibakar Sen**, Professor, Center for Product Design and Manufacturing and Department of Mechanical Engineering, Indian Institute of Science Bangalore, India.
dibakar@cpdm.iisc.ernet.in, +91-80-2293-3230/3137
- **Dr. G. K. Ananthasuresh**, Professor, Department of Mechanical Engineering, Indian Institute of Science Bangalore, India.
suresh@mecheng.iisc.ernet.in, +91-80-2293-2334/3363
- **Dr. B Gurumoorthy**, Professor, Department of Mechanical Engineering and Chairman of the Centre for Product Design and Manufacturing, Indian Institute of Science Bangalore, India.
bgm@cpdm.iisc.ernet.in, +91-80-2293-2304
- **Dr. P. K. Patowari**, Associate Professor, Department of Mechanical Engineering, National Institute of Technology Silchar, India.
ppatowari@yahoo.co.in, +91-94-3552-3391