

STATEMENT OF OBJECTIVES

I am a senior student at Indian Institute of Technology Madras and will be completing my Bachelor's program in Mechanical Engineering in Spring 2012. I wish to pursue the S.M. program leading to a PhD in Mechanical Engineering at Massachusetts Institute of Technology. I am broadly interested in the areas of Heat transfer and Fluid mechanics with special interests in *Convection, Phase Change Phenomena, Microfluidics, Nano-scale Heat Transfer* and *Electronic Cooling Systems*.

My core drive is to persevere and cherish the journey I had embarked upon four years back when I decided to become a mechanical engineer. Hailing from a family of mechanical engineers, my choice appeared conventional in the beginning. But now, I wouldn't be content until I make significant contributions to this field which I have truly enjoyed learning and, also to the academia which has offered me perfect support in all my endeavours.

During my freshman year, I used to take active part in several activities of the Technical Society of IIT Madras so as to discover my true interests. I enthusiastically took up Robotics as my hobby and it captured my attention for almost two years from then, during which time I also thought that it would form my academic interest. In my sophomore year, I (in a team of six) undertook an entirely student driven, institute funded project '*RoboFish*', which was inspired by the robotic fish MT1 (University of Essex, England). We built a bio-mimetic underwater robot with on-board control systems and contributed our own ideas to the original design[†]. Our challenge was to design and fabricate the body using a minimalistic approach in six months. It became one of the main attractions at Shastra'10, the annual technical festival of IIT Madras and was covered extensively by 3 newspapers.

During the summer break of my junior year, I interned at ST Kinetics (Singapore) where I pioneered the experiments for '*Characterization of Li-ion batteries used in Hybrid Electric Vehicles (HEV)*' under the guidance of Mr. Chou Chuen and Mr. Johnny Tan. I designed and integrated the components of the control circuit using CAN (Control Area Network) Protocol to control the charging and discharging of the cells[†]. The results of the experiments improved the accuracy of base data (Voltage Vs State of charge data) used for the HEV energy state calculations by 90 percent. This was when I first identified that I had an inclination towards experimental work.

I developed an interest towards theoretical and experimental research in Thermal sciences during my Fluid Mechanics and Heat Transfer courses at IIT Madras. In the Heat transfer course taught by Prof. Sarit K. Das, I worked on an open-ended project focussing on the '*Use of superhydrophobic surface droplet evaporation for cooling an X-ray tube*' used in the modern CT scan. It was intellectually very demanding and also involved extensive literature survey. Nevertheless, I personally found it quite intriguing to find out more about the phase change phenomena and how it could be effectively used for cooling purposes. Although my resulting design and analytical calculations were quite preliminary, I certainly learnt about the various intricacies involved in modelling a real life problem.

Subsequently, in the '*Convection and Two Phase flow*' course under Prof. S.K. Das, I observed a long-standing concern that no conclusive theory existed for perfectly describing the boiling phenomena even after all these years of research. Spurred by this, I took up my B.Tech dissertation on '*The effects of Acoustic Cavitations on Pool Boiling Heat transfer*', jointly guided by Prof. Dhiman Chatterjee and Prof. S.K. Das. It aims at augmenting pool boiling heat transfer using ultrasonic transducer to enhance bubble nucleation. After modifying the equipment to increase the reliability of the results[†], I have finished the setup of the pool boiling apparatus and I am currently validating the data obtained from this setup against established correlations.

[†] Kindly refer to my resume for further details on the project

The most exciting aspect of this project has undoubtedly been the experimental work involved in discovering the underlying science. I have admired the 'Scientific Method' ever since I was in school and I have always wanted to apply my intellect and creativity to study theories using this method of inquiry. From handling high power equipment in the battery characterisation project to leak-proofing the pool boiling apparatus in my latest project, I have always enjoyed using practical skills in conjunction with theoretical knowledge. Moreover, I have understood the importance of systematic project documentation as I had to face some difficulties myself due to lack of past information.

In order to broaden my knowledge in heat transfer I took up an assortment of electives in heat transfer, including CFD. In the final course project, I modelled the 'Flow past Immersed bodies' in MATLAB using transient 2-D CFD source code (FORTRAN 90) based on Finite Volume Method. Here, I acquired basic simulation skills which I believe would be useful in experimental research too.

My decision to apply for graduate studies to MIT has been influenced by both the intensity and diversity of research carried out there. I found the research happening in the W. M. Rohsenow Heat and Mass Transfer laboratory synchronous with my interests, especially the projects associated with **Prof. Varanasi's group**, **Prof. Lienhard's group** and the **Building technology research group**. I am open to working in, but not restricted to, any of the above areas, preferably involving experimental work.

I believe I have the right aptitude and attitude for graduate studies firstly because, I have been consistently maintaining a good academic record. I currently stand 4th in a class of 113 students at IIT Madras with a 9.16/10 CGPA and my undergraduate studies is entirely funded by the ST engineering scholarship. Secondly, my projects have given me an excellent exposure to diverse fields like design, manufacturing, controls and instrumentation and for the same reason, I believe that the skills, confidence and patience that I gained from these experiences would be of great value in heat transfer research as well. Being a member of the Administration team at 'Centre for Innovation' (CFI, the 24x7 R&D student lab of IIT Madras), I learnt to handle various aspects of lab maintenance such as inventory, people access, space and waste management etc., and I am interested in taking a similar responsibility at one of MIT's renowned labs.

I was one of the 70 meritorious students selected from all over the nation to be a member of the Indian Youth delegation to China 2011. Here, I had the unique opportunity to interact with students from Chinese medium engineering schools and I was fascinated by how world knowledge could be effectively accessed as well as contributed through a non-English medium of instruction. Besides, I learnt to work along with people from ethnically different backgrounds during my internship at Singapore and I believe that these experiences would facilitate me to effortlessly blend with the culturally diverse student and faculty body at MIT.

Before I call myself as an engineer, I want to know what exactly it takes to be one. I see graduate studies at MIT as a way of realizing independence in research and also experiencing diversity in thought and form. In the long run, I wish to lead a pioneering research team either in academia or in industry. Alongside research, I also wish to look into Development Alternatives (which is currently my professional minor) and encourage indigenous innovation in developing communities.

Therefore, I sincerely believe that I am ready to accept the challenges and responsibilities associated with graduate studies at MIT as I am wholly motivated to learn from every experience linked with both the campus and its people. I am looking forward to gaining admission to the SM plus PhD program at MIT with full financial assistance and I reflect that this education might transform the way I think and feel about teaching, learning and most importantly, myself.

Thank you for considering my application.

Divya Panchanathan.

12th November 2011.