

Kaustubh Girish Naik
5th year undergraduate (dual degree)
Department of Mechanical Engineering
Indian Institute of Technology Kharagpur

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Education

Indian Institute of Technology Kharagpur, India Jul 2014 - Apr 2019
BTech MTech (dual degree) in Mechanical Engineering
with M.Tech spec. in Thermal Science and Engineering
GPA **8.88/10.0**, ranked **5** in the thermal Engineering branch.

Shri Dawale Junior College, Akola Jul 2012 - Apr 2014
Maharashtra State Board of Secondary and Higher Secondary Education
Percentage score 92%

Jubilee English High School, Akola Apr 2006 - Apr 2012
Maharashtra State Board of Secondary and Higher Secondary Education
Percentage score 95.27%, Ranked 1st in school

Research Interests

My broad areas of interest are Microfluidics, Electrochemistry, Energy storage (ex. Batteries, Capacitors, etc), Electrokinetics, General transport processes and Heat transfer. I have always believed in multidisciplinary approach for a research to be impactful. I am currently working on multiscale modelling of lithium ion batteries and electrochemical capacitors. In the future, I want to explore the related fields in minute details.

Publications

Kaustubh Girish Naik, Suman Chakraborty and Jeevanjyoti Chakraborty. "Finite size effects of ionic species sensitively determine load bearing capacities of lubricated systems under combined influence of electrokinetics and surface compliance." *Soft Matter*. 2017.

This project was based on a multi-physics problem involving a fluid flow through micro-confinement (a slider bearing setup). Electrokinetic effects due to the presence of the Electrical Double Layer and the consequent influence of Streaming Potential together with the effects of substrate compliance were taken into consideration. The mathematical modelling of the fluid flow through the planer slider bearing based on the lubrication approximation and the modified Reynolds equation (considering electrokinetic effects) was implemented in MATLAB using finite difference method. This research work is hoped to contribute to the betterment of the designs of slider bearings and to the improved understanding of the lubricated surfaces in biological settings.

Internships and Projects

Indian Institute of Technology Kharagpur, India July 2018 - Present
Multiscale modelling of lithium ion batteries and electrochemical capacitors (Energy Storage System)
Advisor: Prof. Jeevanjyoti Chakraborty

A microscopic model for a lithium ion battery was studied which accounts for the diffusion of lithium ions within the electrode particles, transfer of lithium from electrode particles to electrolyte and the subsequent transport within the electrolyte assuming a dilute electrolyte and Butler-Volmer reaction kinetics. Considering the small size of electrode particles relative to the electrode length scale, homogenised model was developed. Using the homogenisation process, macro-scale model was derived in which the coefficients were written in terms of the microscopic parameters. Using the similar approach, a macro-scale model has been developed for an electrochemical capacitor. Currently, this model is being analysed for various designs (geometries) of the electrode particles using COMSOL Multiphysics software.

Mitacs Globalink Research Internship, University of Sherbrooke, Canada Summer 2018
Numerical modelling of Electrocaloric effect in barium titanate.
Advisor: Prof. Sebastien Poncet

In this project, the alternative technologies for refrigeration, namely, Magnetocaloric refrigeration and Electrocaloric Refrigeration were studied in detail. System was designed using barium titanate as an electrocaloric material. Lastly, numerical modelling was done using MATLAB to calculate the adiabatic temperature change.

Indian Institute of Technology Kharagpur, India 2017-2018
Modelling of a lithium manganese oxide/activated carbon asymmetric supercapacitor
 Advisor: Prof. Jeevanjyoti Chakraborty

This project aims at modelling of a hybrid supercapacitor, consisting of a lithium manganese oxide electrode and an activated carbon electrode. Here, lithium manganese oxide is the redox couple electrode while the activated carbon electrode is the double layer electrode. The modelling of this hybrid supercapacitor is done using COMSOL Multiphysics.

Indian Institute of Science, Bangalore, India Summer 2016
Electrokinetic Flows through micro-confinements
 Advisor: Prof. Pradip Dutta

Topics covered in this project include Electrical Double Layer (EDL), Boltzmann distribution of ions, Potential field and velocity field of the ions in the micro and nano channels. Electrokinetic effects like Streaming Potential, Electroosmosis, Electrophoresis and their mathematical representation in parallel plate micro confinement was also studied in detail in this project.

Indian Institute of Technology Kharagpur, India 2016
A statically balanced mechanism to keep a hinged-door open at any desired position
 Advisor: Prof. Sovanlal Das

Aim of this project was to replace a standard door damper with a statistically balanced mechanism which will keep a hinged-door open at any desired position. The design of this mechanism was successfully done and was presented using a CAD model along with stress analysis of its components.

Academic Honors and Awards

Mitacs Globalink Scholarship-for funding a research internship in Canada. 2018
Summer Research Fellowship-for funding a research internship at IISc, Bangalore. One of the 3 students from my college. 2016
Kishore Vaigyanik Protsahan Yojana (KVPY) Scholar-was awarded to only 200 students by Dept. of Science and Technology, Govt. of India for academic excellence in basic sciences. 2013
National Talent Search Scholarship-among top 0.1 percent students in India. 2010
National Mathematics Talent Contest-Secured All India Rank 16. 2010
Maharashtra Talent Search Scholarship-Secured State rank-7 and State rank-11 in 2010 and 2011 respectively. 2010 & 2011

Technical Skills

Proficient: MATLAB, COMSOL, ANSYS, Solidworks, Engineering Equation Solver (EES), C Programming
Familiar: Mathematica, Abacus

Relevant Coursework

Microfluidics	Computational Fluid Dynamics	Advanced Fluid Mechanics
Convective Heat and Mass Transfer	Conduction and Radiation Heat Transfer	Thermodynamics
Computational Methods in thermal Engineering	IC Engines	Turbomachinery
Air Conditioning and Ventilation	Power Plant Technology	Refrigeration
Systems and Controls	Design of Machine Elements	Mechanics of Solids
Dynamics of Machines	Kinematics of Machines	mechanics

Extra Curricular Activities

Gold Medal in Inter-hall Eastern Vocals (Singing) Competition at IIT Kharagpur. 2018
 Gold medal in Inter-hall Band Competition at IIT Kharagpur. 2018
 Member of the Inter-hall Product Design Team at IIT Kharagpur. 2017
 Achieved All India Best Cadet III Award (NCC) in Republic Day Camp Delhi 2011
 Selected for state level Table Tennis tournament. 2010