



भारतीय प्रौद्योगिकी संस्थान (भारतीय खनि विद्यापीठ), धनबाद

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(An Autonomous Institute under Ministry of HRD, Govt. of India)

### Letter of Recommendation for Mr. Atul Kumar Verma

Mr. Atul Kumar Verma is an M. Tech. student at the Department of Mechanical Engineering, IIT (ISM) Dhanbad and is known to me since the last year. This is when I joined as an Assistant Professor at the department, after completing my Ph.D. at the University of Cambridge in 2020. Atul had taken the courses: Computational Fluid Dynamics (MEC551) and Thermal Engineering Lab (MEC552) which I taught from January 2021 to April 2021. He secured a B+ in both the courses and overall, he is among the top five students in his year. He showed remarkable curiosity during the course work, even with teaching being in online mode.

In his third semester, Atul started work on his Master's thesis under my guidance. Since our work is mainly in the areas of high-performance computing, fluid mechanics, and transition to turbulence, Atul was encouraged to work on a flow instability problem of combined Kelvin-Helmholtz and Rayleigh-Taylor instability by performing direct numerical simulations. The objective was to distinguish between the buoyancy-driven and convection-dominated mechanisms at play. This was to be done numerically using highly accurate schemes for computing.

As Atul was not familiar with computing especially using the high-performance computing facilities at the institute, he was guided over Google meet to understand the basics of computing and hydrodynamic instabilities. Atul has shown great initiative and took interest in the computing part of the project. Recently, a manuscript has been communicated to Physical Review E. based on Atul's thesis work. Throughout preparing the manuscript, Atul has spent time learning and developing algorithms for processing and analyzing the data.

Atul is an honest, hardworking individual who has shown his tenacity to learn in less-than-ideal circumstances prevailing during the pandemic, supplemented by self-study of research materials. He has made sustained efforts in processing and analyzing the results. Since mid-October, 2021 Atul has been able to come to the IIT campus and we have further progressed in the subsequent aspects of his thesis work, with many aspects of the problem in the pipeline.

Atul has been tenacious and shown great strength of character, especially in the face of his family being affected by COVID-19. He comes across as a well-mannered, caring young man who is always keen to help out his peers. I am sure that he will do well in his chosen research field. Thus, I have no hesitation in recommending him for the joint Ph.D. program between IIT Kharagpur and the University of Manchester.

(Aditi Sengupta)

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