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Prof. Tim
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Imperial College London

Dear Prof. Tim,

I am Ruizhi Yu, a PhD candidate at Southeast University, anticipating graduation in June 2025. I am writing to express my keen interest in the research associate position at your group within Imperial College London, particularly the role focused on Accelerated EMT Simulation. With a strong background and specific expertise, I am confident that my qualifications align well with the requirements of this position.

1. Research Experiences

Throughout my doctoral studies, my research has concentrated on the development of time-domain simulation algorithms for integrated electricity-gas-heat energy systems. This work has equipped me with a thorough understanding of advanced semi-analytical and numerical techniques. Specifically, I have delved into semi-analytical methods such as multi-stage discontinuous Galerkin, differential transformation, and holomorphic embedding. Leveraging their non-iterative characteristics, I have successfully applied these methods to the simulation of active distribution networks with high photovoltaic (PV) penetration and integrated electricity-heat networks, significantly reducing computational overhead associated with high-dimensional iterations. This effort has culminated in the publication of two articles in JCR-Q1 journals.

Recognizing the stability advantages of semi-analytical methods, I also explored numerical approaches to achieve both computational efficiency and implicit stability. Working collaboratively with Professor Gerd Steinbach from Hochschule Bonn-Rhein-Sieg, I contributed to the creation of the first open-source Python implementation of the stiffly accurate Rosenbrock method (Rodas). This tool was instrumental in improving the convergence of ill-conditioned power flow analyses and post-fault simulations of integrated electricity-gas systems. Currently, two related manuscripts are undergoing peer review in JCR-Q1 journals.

Building upon this foundational knowledge, I am presently engaged in the development of simulation frameworks for mixed-EMT-electromechanical digital twins. My focus here is on the mathematical core of multi-rate simulation algorithms and the bidirectional interactions between EMT and electromechanics. These experiences have honed my analytical skills and solidified my theoretical grounding, making me well-prepared for the challenges of this position.

2. Project Experiences

Beyond my academic research, I have spearheaded the development of Solverz, an open-source simulation modeling framework designed for flexible extensions and optimized performance. This platform

includes symbolic modeling interfaces and code printers for generating numerical functions, facilitating the implementation of a wide range of algorithms. To support the community, we have launched two websites dedicated to simulation recipes and a model library, enhancing collaborative research in integrated energy systems.

As the primary contributor and maintainer of Solverz, I have gained substantial experience in programming languages like Python, Matlab, and Julia, with a focus on performance optimization, including just-in-time compilation. Additionally, I have become adept at project management through the use of distributed version control systems such as Git.

Furthermore, I have been actively involved in various projects across mainland China. Notably, I applied my simulation solvers to operational scenarios in a cross-border multi-energy system between Yunnan, China, and Muse, Myanmar. Similarly, the solver has proven effective in managing a city-level multi-energy system in Jilin, China. These engagements have enriched my practical problem-solving abilities and deepened my understanding of real-world applications.

Given my research and project experiences, I am convinced that I would be a valuable addition to your research team. I have submitted my CV through the application system for your review. Should you require further details or have any questions, please do not hesitate to contact me. Thank you for considering my application, and I look forward to the possibility of contributing to your esteemed group.

Sincerely yours,

Ruizhi Yu

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