Pos-doc Topology optimization method applied to solid oxide fuel cells design - REF 23PDR251
University de São Paulo

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Department Mechanical Engineering
https://sites.usp.br/rcgi/

Institution University de São Paulo
Sao Paulo, Sao Paulo, Brazil

Date Posted Apr. 5, 2024

Application Deadline Oct. 8, 2023

Position Start Date Oct. 10, 2023

Job Categories Post-Doc

Academic Field(s) Engineering Mechanics

Job Website https://sites.usp.br/rcgi/opportunities/

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Job Description

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We are currently offering a postdoctoral opportunity focused on fuel cell modeling and optimization. The candidate will collaborate with researchers from the FAPESP-Shell Research Centre for Innovation and development of hydrogen mobility devices at the Polytechnic School of the University of São Paulo. Summary of the program and projects can be found on the RCGI website (http://www.rcgi.poli.usp.br/). The projects have formal collaborations with Imperial College London, in England, Texas A&M University, in the USA, and Kyoto University, in Japan. In addition, the projects aim to create start-ups with the results obtained. Hydrogen mobility is an area of study that has a great demand for the development of devices and equipment, mainly fuel cells and electrochemical reactors. While the fuel cell generates energy from hydrogen, electrochemical reactors generate hydrogen from ethanol, for example. The selected candidate will have the opportunity to contribute to cutting-edge research in the field of numerical modeling and optimized design of electrochemical devices, with a particular focus on solid oxide fuel cells. In this context, a promising technique is the topology optimization method, which is a powerful optimization method for conceptual design. This research proposes to incorporate several challenging objective functions with respect to fluid (efficiency, pressure ratio) and electrochemical reactions (cell resistance, activation potentials, cell power), developing new topology optimization formulations for engineering systems design in diverse applications. The numerical implementation will be done using open source software , such as FEniCS/dolfin-adjoint, or commercial software, such as COMSOL Multiphysics®.

The applicant will contribute in line with the main objectives of the project:
1.Develop numerical models for multiphysics simulation (Electric and Ionic Charge Carrier Transport, fluid flow and multi-component porous media gas transport, electrochemical charge transfer reactions, heat transfer) of solid oxide fuel cells;
2.Develop a design methodology for fuel cells based on the topology optimization method aiming to maximize efficiency in energy generation, reduce failures due to thermal effects resulting from operation, and reduce weight/mass.
3.Perform computational simulations of the optimized cell configurations considering the multiphysical electrochemical behavior, fluid flow, and heat transfer.
This project wuld be well-suited to a highly motivated candidate and requires programming skills in Matlab, Python or C++, experience in multiphysics computational modeling with FEniCS or COMSOL Multiphysics® software, proficiency in English, and experience in computational mechanics, finite element method, topological optimization, and algorithm analysis.
- The postdoc candidate should hold a PhD in Engineering, with the skills described above.
This Postdoc fellowship is funded by FAPESP. The fellowship or scholarship will cover a standard maintenance stipend of R$ 9.047,40 per month.

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Contact Information

Please reference Academickeys in your cover letter when applying for or inquiring about this job announcement.

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