School of Computing, Engineering, and the Built Environment
Edinburgh Napier University

PHD STUDENT PROJECT

Funding and application details

Funding status: Self-funded students only

Application instructions:
Detailed instructions are available at https://www.napier.ac.uk/research-and-innovation/research-degrees/how-to-apply

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:
- DIRECTOR OF STUDY: Nazmi Sellami (Email: N.Sellami@napier.ac.uk)
- 2ND SUPERVISOR: Firdaus Muhammad Sukki

Subject Group: Engineering & mathematics

Research Areas: Engineering, Energy Technologies, Environmental Engineering, Fluid Mechanics, Mechanical Engineering, Robotics, Thermodynamics

Project Title: PV soiling – Design of sustainable cleaning system

Project description:
Global warming is mainly due to the high growth in carbon emissions and pollution worldwide. At present, most countries have set carbon reduction goals. They are promoting energy transition to switch from fossil fuels to renewable and clean energy sources (solar, wind and Hydro).

The MENA region (the Middle East and North Africa) has the potential to provide a sustainable electricity supply to Europe using solar energy. However, a significant problem faces solar farms and PV installations in the desert and polluted areas. The problem is known as PV soiling. It is a major factor that prevents solar

irradiation from reaching the cells and significantly reduces the electrical performance of photovoltaic systems.

Conventional PV cleaning systems defeat the purpose of sustainability and renewable energy. They require a considerable quantity of water and energy to frequently clean the solar panels.

This project is about designing a novel automated cleaning system to keep the PV panel clean all the time and enhance the performance of the PV installations.

This research project combines computational fluid dynamics (CFD) and experimental work to optimise and design an energy-efficient PV cleaning system.

For more information about the project, don't hesitate to get in touch with Dr Nazmi Sellami N.Sellami@Napier.ac.uk

References:
[1] FIGGIS, B., ENNAOUI, A., AHZI, S. & RÉMOND, Y. 2017. Review of PV soiling particle mechanics in desert environments. Renewable and Sustainable Energy Reviews, 76, 872-881.
[2] KHAN, M. U., ABBAS, M., KHAN, M. M., KOUSAR, A., ALAM, M., MASSOUD, Y. & JAFRI, S. H. M. 2021. Modeling and design of low-cost automatic self cleaning mechanism for standalone micro PV systems. Sustainable Energy Technologies and Assessments, 43, 100922.
[3] SMESTAD, G. P., GERMER, T. A., ALRASHIDI, H., FERNÁNDEZ, E. F., DEY, S., BRAHMA, H., SARMAH, N., GHOSH, A., SELLAMI, N., HASSAN, I. A. I., DESOUKY, M., KASRY, A., PESALA, B., SUNDARAM, S., ALMONACID, F., REDDY, K. S., MALLICK, T. K. & MICHELI, L. 2020. Modelling photovoltaic soiling losses through optical characterization. Scientific Reports, 10, 58.

Candidate characteristics

Education:
A second class honour degree or equivalent qualification in Mechanical Engineering

Subject knowledge:
- Fluid Dynamics

Essential attributes:
- Experience in fundamental Mechanical Engineering applied to renewable energy devices
- Competent in Computational Fluid Dynamics
- Knowledge of solar energy
- Good written and oral communication skills
- Good time management

Desirable attributes:
- knowledge of Photovoltaic conversion and efficiency