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Experimental investigation on jet array SiO_2-water nanofluid impingement of photovoltaic/thermal collector

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The effect of nanoparticles (SiC) with water as its base fluid on the electrical and thermal performance of a photovoltaic thermal (PVT) collector equipped with jet impingement has been investigated. A PVT collector was tested indoor at set levels of solar irradiances and mass flow rates. The system consists of four parallel tubes and 36 nozzles that directly inject the fluid to the back of the PVT collector. The electrical performance of the PVT collector was determined based on the mean temperature of the PVT absorber plate. The SiC/water nanofluid system reported the highest electrical and thermal efficiency. The electrical, thermal, and combined photovoltaic thermal efficiencies were 12.75%, 85%, and 97.75%, respectively, at a solar irradiance of 1000 W/m^2 and flow rate of 0.167 kg/s and ambient temperature of about 30°C. Moreover, the Pmax of PVT with SiC nanofluid increased by 62.5% compared to the conventional PV module.

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A biologically inspired paradigm for intelligent cyber-physical smart grid modeling and control

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It is well known that information will play an important role in enhancing emerging smart grid system operation. Questions therefore naturally arise as to when the increased data-dependence may be considered excessive. Two practical considerations emerge: 1) Communications and computational overhead, in which redundant and irrelevant information acquisition and use results in heavy computational burden with limited performance return, and 2) increasing risks of power system disruption due to information delay from communication congestion or cyber-attack. One strategy to improve smart grid resilience is to determine the appropriate degree of dependence on cyber information to balance performance with overhead and risk. In this talk, I will introduce our work in developing an intelligent cyber-physical multi-agent model of smart grid system operation based on flocking theory in the context of the transient stability problem. Through this model, we have studied strategies that harness a selective degree of cyber technology by leveraging physical couplings. Our formulation enables the identification of large-scale distributed control strategies for robust and resilient power grid operation.

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