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| **Title:** | Design and Simulation of a DC-Powered Solar-Based Water Pumping System | | |
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| **Abstract:** |  |
| Abstract— This paper presents the design and simulation of a DC-powered solar-based water pumping system using MATLAB/Simulink. The system integrates a photovoltaic (PV) section, a Maximum Power Point Tracking (MPPT) algorithm, and a Permanent Magnet Direct Current (PMDC) motor operating a centrifugal pump. The objective is to enhance irrigation efficiency in rural and remote areas. Simulation results demonstrate the effectiveness of the designed system with an overall efficiency of nearly 74.70%. The MPPT algorithm achieves an average efficiency of 85%, while the motor and pump operate at ideal and maximum efficiencies of 99% and 88.78%, respectively. These findings validate the system’s capability to maintain high efficiency and reliable operation under varying solar conditions, highlighting its potential as a sustainable solution for off-grid water management and agricultural productivity in developing regions. | |