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Article

Maximum Power Point Tracking for Brushless DC Motor-Driven Photovoltaic Pumping Systems Using a Hybrid ANFIS-FLOWER Pollination Optimization Algorithm

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Abstract: In this research paper, a hybrid Artificial Neural Network (ANN)-Fuzzy Logic Control (FLC) tuned Flower Pollination Algorithm (FPA) as a Maximum Power Point Tracker (MPPT) is employed to amend root mean square error (RMSE) of photovoltaic (PV) modeling. Moreover, Gaussian membership functions have been considered for fuzzy controller design. This paper interprets the Luo converter occupied brushless DC motor (BLDC)-directed PV water pump application. Experimental responses certify the effectiveness of the suggested motor-pump system supporting diverse operating states. The Luo converter, a newly developed DC-DC converter, has high power density, better voltage gain transfer and superior output waveform and can track optimal power from PV modules. For BLDC speed control there is no extra circuitry, and phase current sensors are enforced for this scheme. The most recent attempt using adaptive neuro-fuzzy inference system (ANFIS)-FPA-operated BLDC directed PV pump with advanced Luo converter, has not been formerly conferred.

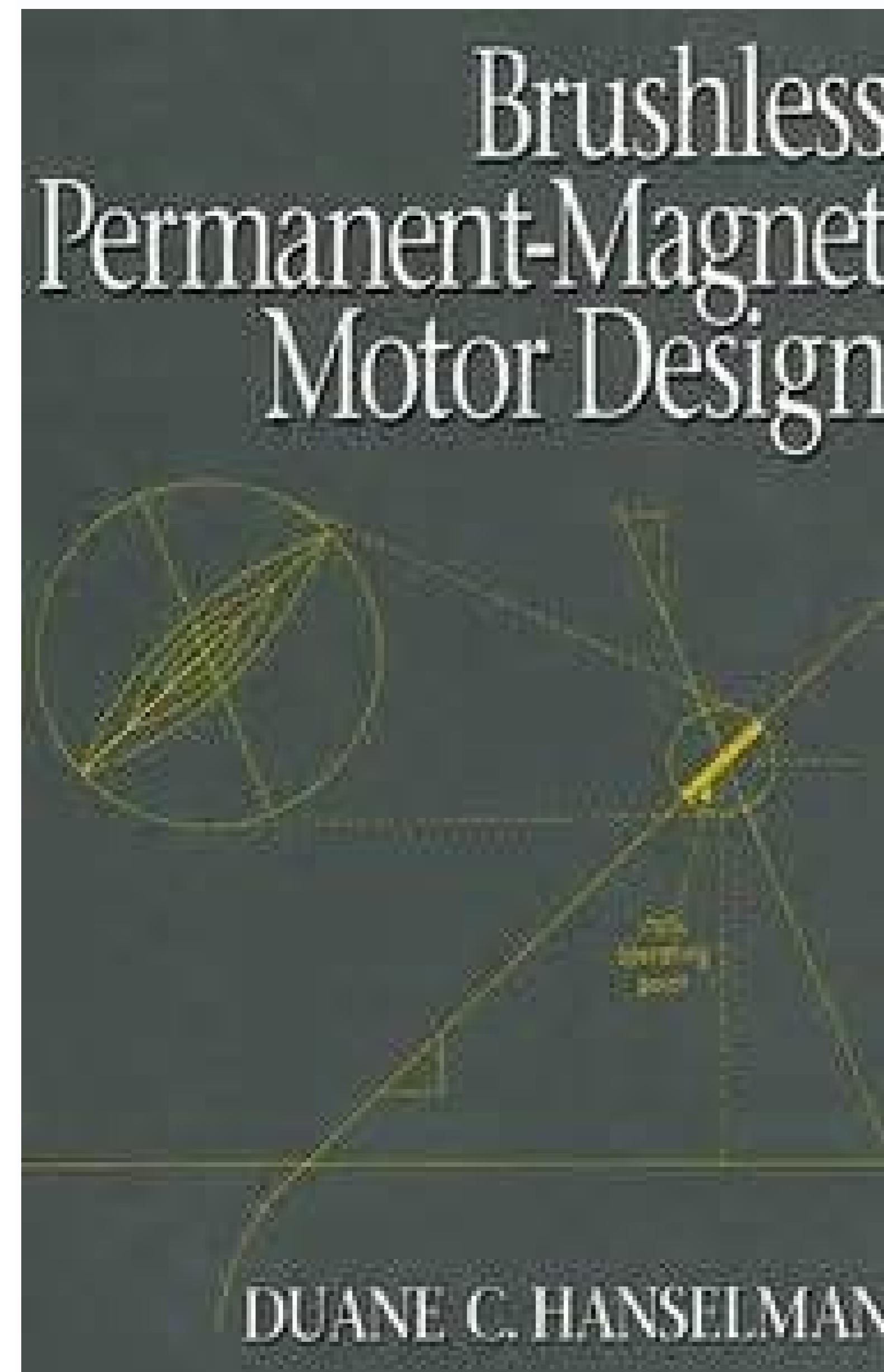
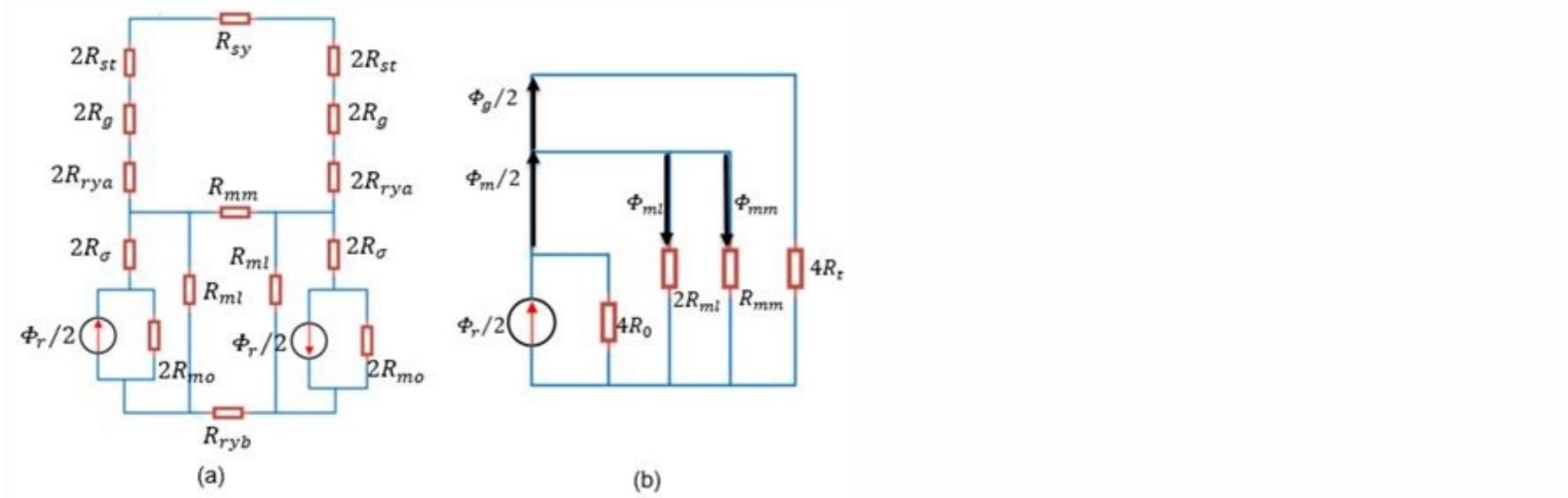
Keywords: ANFIS; artificial neural network; brushless DC motor; FPA; maximum power point tracking; photovoltaic system; root mean square error

1. Introduction

As conventional energy sources are depleting day by day, the demand for renewable energy sources is raising [1–3]. Solar energy sources are promising renewable energy sources for developed and developing nations due to being free, abundant, and environmentally friendly. Standalone photovoltaic (PV) systems for water-pumping applications are employed in remote areas [4,5]. Because of grid absence in remote places, standalone PV water pumping is installed for agricultural and household applications. Various electric motors have been used to drive the pumping system [6,7]. The DC motor-based pumping system requires maintenance because of commutator and brush presence. Therefore, DC motors are not frequently used for PV pumping applications. Single-phase induction motors have also been used for driving low-inertia torque load. Due to a complex control strategy, the induction motors are not efficient for pumping applications. Therefore, in this research work, a brushless DC (BLDC) motor has been considered as it has simple design control, low power

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