

Abstract

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An efficient unity power factor battery charging/discharging unit

Rechargeable battery is considered to be one of the main electric energy storage devices. Due to the problem of possible shortage of energy resources, cost environmental considerations, a power saving and energy efficient devices become frequent request and important need. Therefore, within this appear a single phase battery charger/discharger set is proposed, which operates in two different modes. An empty battery is charged directly from ac source through the control of a PWM rectifier converter, followed by a dc/dc buck regulator in the first mode, which is called charging mode. Second mode is discharging mode, as the set is utilized to discharge and transfer the energy from a charged battery to charge another empty battery, hence a power saving has been obtained. Such charging and discharging operations could be frequently required, particularly during batteries manufacturing, tests, maintenance and also can be adopted to be utilized within recent vehicle to grid applications. The proposed PWM rectifier offers a sinusoidal supply current at unity power factor and improves the total harmonic distortion during the two modes of operations, hence providing high power quality operating conditions. The proposed set is simulated using PSCAD software to evaluate the system performance. Furthermore, experimental setup of the proposed system is implemented and experimental results have been agreed with simulation results, validating the proposed set for practical applications.