ESTIMATING STATE OF CHARGE OF SMALL SCALE BATTERY STORAGE

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DECLARATION

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ABSTRACT

Lead-acid batteries are often used as the energy storage component for small-scale photo-voltaic(PV), systems in the developing world, allowing electricity to be supplied when generation is not occurring. Batteries often account for a significant fraction of the capital cost of the system and also have the shortest lifetime when compared to solar panels ect. In simple systems, the management of the battery sub-system is often crude, with the battery charged directly via a solar panel through a simple reverse-blocking diode and supplying an inverter incorporating a simple under-voltage cut-out in an attempt to avoid over-discharge. This leads to frequent over-charging (and over-discharging if the voltage cut-out is set incorrectly) of batteries and early failure, necessitating costly refurbishment or replacement. Also when several batteries are in series or parallel the extractable energy from the whole battery is limited by the capability of the weakest battery in the group. But if the SOC(State of Charge) batteries in a group, can be determined in advance, to determine the point of cut-off for charging or discharging, the extractable energy can be increased without sacrificing the life of batteries. This paper discuss different techniques that are used today in determining the SOC of batteries in the lines of its applicability of the particular case of group of batteries. This thesis thoroughly investigate the applicability of state variable approach proposed by John Chiasson and Baskar Vairamohan in "Estimating the State of Charge of a Battery" for the case of more than one battery, where it considers only terminal voltage and current of the battery for estimating the SOC. In this approach a non-linear time varying system is simplified to a linear time varying system with some reasonable assumptions. This approach was verified for different types of batteries at different state of health. It was also verified that the same method is applicable to find out the week battery in a string of series of batteries. The paper in its final chapter proposes a technique which is general and applicable for determining the discharge cut-off point based on rate of change of terminal voltage.

Key words: State of charge, Control theory, Battery.

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