Induced effect on the solar panel due to Narrow Bipolar Pulses

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With growing concerns about the environment due to the use of fossil fuels, the adoption of green energy is gaining popularity worldwide. Solar power is the major green energy source in Sri Lanka. Solar photovoltaic (PV) systems are being damaged due to direct and indirect lightning strikes. This study aimed to investigate the lightning-induced effect on solar PV systems due to Narrow Bipolar Pulses (NBPs). The experimental setup consists of a solar panel and a microinverter mounted on the rooftop of the Department of Physics at the University of Colombo, Sri Lanka (6.9024° N, 79.8607° E). We measured the simultaneous common-mode DC^+terminal induced voltage and current through the DC^+terminal with the vertical electric field signatures of the NBPs. Among the recorded eighty-three pulses, seven were identified as Negative Narrow Bipolar Pulses (NNBPs). Analysis was conducted with those seven files. A burst of pulses has been induced on solar panels at NNBPs, while the simultaneously induced current was negligible. The highest peak-to-peak voltage of 1.44 V was induced at NNBP amplitude of 11.07 V/m. The mean value of the peak to-peak induced voltage was (0.98±0.10) V, whereas the standard deviation was 0.26 V. The respective mean value and the standard deviation of the induced voltage pulse duration were (32.85±1.93) µs and 5.09 µs. Although the peak amplitude variation of the NNBPs and the DC^+ terminal induced voltage shows a moderate positive correlation, further analysis of more pulses is required to determine the exact relationship between the two parameters. Gaining knowledge of the waveshape, amplitude, pulse duration and other statistical parameters of the lightning-induced voltage and current is important in designing protection for solar PV systems. Hence, further investigations are needed to verify our experimental findings and reveal more details of the induced effect on solar panels due to NBPs.

Keywords: *Induced effect, Lightning, Narrow Bipolar Pulses, Protection, Solar panel*

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