This paper presents a technique for maximum power point tracking (MPPT) of a concentrating photovoltaic system using cell level power optimization. Perturb and observe (P&O) has been a standard for an MPPT, but it introduces a tradeoff between the tracking speed and the accuracy of the maximum power delivered. The P&O algorithm is not suitable for a rapid environmental condition change by partial shading and self-shading due to its tracking time being linear to the length of the voltage range. Some researches have been worked on fast tracking but they come with internal ad hoc parameters. In this paper, by using the proposed unbounded binary search algorithm for the MPPT, tracking time becomes a logarithmic function of the voltage search range without ad hoc parameters.

Abstract

This paper presents a technique for maximum power point tracking (MPPT) of a concentrating photovoltaic system using cell level power optimization. Perturb and observe (P&O) has been a standard for an MPPT, but it introduces a tradeoff between the tracking speed and the accuracy of the maximum power delivered. The P&O algorithm is not suitable for a rapid environmental condition change by partial shading and self-shading due to its tracking time being linear to the length of the voltage range. Some researches have been worked on fast tracking but they come with internal ad hoc parameters. In this paper, by using the proposed unbounded binary search algorithm for the MPPT, tracking time becomes a logarithmic function of the voltage search range without ad hoc parameters.

The Proposed Unbounded Binary Search (UBS)

- Voltage steps change automatically

Simulation scenario

- DNI=850W/m²
- Iteration 0
  - Partial shading
  - 3/4 of a cell shaded
- Iteration 90
  - Partial shading condition is released
  - DNI is reduced to 60%

Simulation results

- Power vs. Voltage
- Tracking Procedure

Flow Chart

- Start
- Sense V(k) & I(k)
- P(k)=V(k)I(k)
- Reset P=0
- P(k)>max(P) Y Y
- N
- Y
- N
- D=-D
- V(k+1)=V(k)+ΔD
- m=m-1
- N
- N
- N
- N
- Y
- N
- Y
- m=0, k=1
- Return