Comparison of Maximum Power Point Tracking Techniques in Electrical Power Systems of Cubesats

Jesus Gonzalez-Llorente
Escuela de Ciencias Exactas e Ingenierías
Universidad Sergio Arboleda
Bogotá D.C., Colombia
jesusd.gonzalez@correo.usa.edu.co

Eduardo I. Ortiz-Rivera
Dept. of Electrical and Computer Engineering
University of Puerto Rico-Mayagüez
Mayagüez, Puerto Rico
eortiz@ece.uprm.edu

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Agenda

• Introduction
  – From Libertad 1 to Libertad 2

• The problem
  – Selection of MPPT algorithm for EPS

• Method
  – Simulation over one orbit of MPPT techniques

• Results
  – Comparison of Energy for each Technique
  – Future work
Introduction

- Classification: Nanosatellite
- CubeSat (Academic)
- Application: Earth Observation
- Orbit: LEO
Introduction

Ground Station
Introduction

1. Development of an image acquisition system for Cubesat

2. Optimization of power systems
The problem

Perturb-and Observe (P&O)
Linear Reoriented Coordinates Method (LRCM)
The problem
Environment conditions

Sunlight

Illuminated area

Dark area

![Graph showing irradiance over time for different sides of the Earth.](image-url)
Environment conditions
Results

![Graph showing power and time]
Results
Results
Results
Conclusions

• The ideal operating point of the PV cells was estimated during the orbit sunlight period to be used as a benchmark for the MPPT comparisons

• Both MPPT methods presented a similar performance over an entire sunlight period
Conclusions

• An effective operation of LRCM requires precision in the mathematical model of the PV panel.
• LRCM could be implemented without the disconnection of the PV panel.
• In the case of P&O method, a careful selection of the sampling time and the step size must be done for its correct operation.
Future work

• Different situations without attitude control are being analyzed to know the performance of the MPPT
Future work
Future work

1. Experimental validation

2. Experimental validation
Thank you!

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Questions?

Speaker:
Jesús González-Llorente
jesusd.gonzalez@correo.usa.edu.co

Technical Director of Libertad 2:
Jorge.soliz@usa.edu.co
References

• of Kentucky. 2011.
References


• Azur Space. 30% Triple Junction GaAs Solar Cell. 2012. Available at: http://azurspace.de/index.php?mm=162.
References


• Erb D. Evaluating the Effectiveness of Peak Power Tracking Technologies for solar array on small spacecraft. Master Thesis. University
**Lighting**

Satellite-Libertad2: Lighting

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**Sunlight Times**

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**Global Statistics**

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**Penumbra Times**

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• Eccentricidad=0.009
• Inclinación=98 grados
• Longitud de nodo ascendente=191 grados
• Argumento del perigeo=189 grados
• Anomalía verdadera=0 grados