

Seminar

Institute for Plasma Research

Title : Diagnostics of Electrostatic Discharges and Postulations for Arc Mitigation Techniques on Satellite Solar Panels

Speaker : Ms. R. S. Joshi
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Date : 4th May 2017 (Thursday)

Time : 04.00 PM

Venue : Committee Room 3, (New Building), IPR

Abstract :

Reportedly observed failures in various satellite components operating at higher voltage values are serious issues for Space communities. The maximum value of power generated by the solar panel is dependent on the type and configuration of solar cells laid on it. Charged species in space are responsible for building up static voltages on external satellite components at different potentials based on their dielectric properties. Proximity between two charged surfaces at different potentials results into an electrostatic discharge (ESD) or arc. These discharges damage the surface properties of the solar cells and reduce power generation capacity. To address this situation, an integrated facility for generating such arcs on satellite solar coupons inside a vacuum chamber is developed.

This facility primarily focuses on advanced data acquisition and analysis system for measurement of arc electrical and optical signals, proposal of arc mitigation techniques and development of an arc location predictor algorithm. Features like automated arc acquisition and categorization process, improved arc image capturing rate and algorithm for extended PSA durations are incorporated in the DAQ system. A real-time controller is used to acquire electrical and optical signals during arc. Post-processing algorithm is developed within the frameworks of computation time and storage memory. V-model approach is applied to program all the DAQ modules using LabVIEW graphical programming environment. Thus an integrated facility for arc data acquisition and analysis is developed and validated [1].

Various primary and sustained arc experiments are performed on actual and artificial triple junctions. Two mitigation techniques proposed in this thesis are reduced usage of grouting material and re-arrangement of solar cells on the solar panels [4, 5]. Based on the vast database generated due to diversity in experiments, a model for predicting arc location on a two dimensional surface is also proposed [2]. This model uses image processing as its backbone. Apart from arc location, arc velocity and surface propagation region can also be estimated [3].

References

- 1) R. S. Joshi and S. B. Gupta, Elsevier – Measurement, Volume 95, January 2017, pp: 465–472
 - 2) R. S. Joshi and S. B. Gupta, IEEE Transactions on Plasma Science, Volume 43, Issue 9, pp: 3000-3005
 - 3) R. S. Joshi and S. B. Gupta, Volume 23, Issue 1, pp: 8-13
 - 4) S. B. Gupta, S. Mukherjee, K. R. Kalaria, N. P. Vaghela, R. S. Joshi, S. E. Puthanveetil, M. Sankaran and R. S. Ekkundi; IEEE Transactions on Plasma Science, Volume 43, Issue 9, pp: 3041-3046,
 - 5) S. B. Gupta, S. Mukherjee, K. R. Kalaria, N. P. Vaghela, R. S. Joshi, S. E. Puthanveetil, M. Sankaran and R. S. Ekkundi; IEEE Transactions on Plasma Science, Volume 42, Issue 4, Page: 1072-1077
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