

## Improving Sun Energy Harvesting, A Novel Approach for the Design and Optimization of Advanced High Efficiency Solar Cells, Part II

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### Dr. Sherif Michael

Professor, Electrical & Computer Engr. Dept. / Space System Academic Group / Energy Academic Group



Dr. Sherif Michael

#### Abstract:

Photovoltaic Devices commonly known as Solar Cells, are the key components of any solar power systems. This presentation addresses our research efforts at NPS for the design, modeling and optimization of state-of-the-art space and terrestrial based solar cells. A new method for developing a realistic model of any type of solar cell using the SILVACO/ ATLAS Virtual Wafer Fabrication (VWF) software was developed at the Naval Postgraduate School (NPS). Taking into account the high cost of research and experimentation involved with the development of advanced cells, this novel methodology was developed. In our opinion, the introduction of this modeling technique to the photovoltaic community will prove to be of great importance for aiding in the design and development of improved advanced solar cells. A multi-junction InGaP/GaAs/Ge solar cell was successfully modeled and was fully simulated. The model performance was in close agreement with the experimental results of the manufactured cell. Novel optimization techniques, using genetic search algorithm were first introduced and utilized to maximize the new device efficiencies, which resulted in designs that exceeded the performance of most of the best known available cell. The major goal of this research is also to bridge the gap between current state of the art manufactured cells at 30% efficiency, and the theoretical limit of more than 40%. Further research in the design and optimization of low-cost flexible thin film solar cells is currently underway. The availability of such high efficiency cell would be of great value in reducing the energy cost for most solar energy system applications.

This seminar is the second of a two part series presented by Dr. Michael.

#### Biography:

Received the B.S.E.E., the M.S.I.E. & the Ph.D. degrees in 1974, 1980 & 1983, respectively. He joined the Department of Electrical and Computer Engineering at the Naval Postgraduate School, Monterey Ca, in 1983, where he is currently a Professor. He has been one of the founding members of the NPS Space Systems Academic Group since it's initiation in 1985. He has more than 120 technical publications in professional Journals and international conference Proceedings. In over 30 years as a faculty member at NPS, he has served as thesis advisor for more than 110 ECE/Space students. He organized and chaired the 1998 IEEE International Symposium on Circuits and Systems, in Monterey, CA. He also organized and chaired the 34th Midwest Symposium on Circuits and Systems, in Monterey, CA, in 1991. His present research interests are in the following areas:

- Modeling, Design and Optimization of Multi-Junction and Thin Film Solar Cells.
- Applications of CIGS Thin Film Solar Cells for enhancing the capabilities of UAVs.
- Radiation and Space effects on Photovoltaic devices, Multi-junction, Gallium Arsenide (GaAs) and Indium Phosphide (InP) solar cells, and Spacecraft power system design.

He is registered as a Professional Engineer.



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