# FPGA-Based Serialization and Deserialization of 80 Optical SPM Health Signals


## *Abstract*

This work presents an approach for the acquisition, processing, and transfer of 80 optical signals originating from Switched Power Modulator (SPM) modules, with each signal representing the health status of a specific SPM. The optical signals will be first converted into electrical signals and fed into a primary FPGA, which functions as a slave unit for collecting and preparing the data. Custom logic implemented in Vivado software serializes the 80 parallel signals into a single serial data stream, which is then transmitted to a secondary FPGA. The secondary FPGA acts as the main controller, responsible for deserializing the data back into the corresponding 80 parallel signals and coordinating with multiple systems for monitoring, analysis, and control. This approach significantly reduces I/O pin utilization on both FPGAs, simplifying hardware interconnections and making the system more modular.

Reliable and accurate signal transfer while maintaining the integrity of each SPM health signal will enable the precise real-time monitoring of all modules. The system is scalable and suitable for future expansion to accommodate larger arrays of SPM modules, if needed.

The proposed project incorporate a practical and organized framework for handling multiple high-channel-count digital signals, demonstrating the effectiveness of FPGA hardware and Vivado software in implementing custom serialization and deserialization logic.

Prior knowledge of FPGA, hardware description languages (HDLs), and embedded systems is preferred but not mandatory. The primary performance metric will be a working and successful demonstration of reduced number of signals, along with a scalable model capable of supporting up to 80 signals.


## Academic Project Requirements:

**1) Required No. of student(s) for academic project: 2**

**2) Name of course with branch/discipline: B.E./B.Tech. Electronics and Instrumentation Engineering**

**3) Academic Project duration:**

**(a) Total academic project duration: 12 Weeks**
**(b) Student's presence at IPR for academic project work: 5 Full working Days per week**


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