

**DESIGN AND ANALYSIS OF NEURAL FUZZY BASED DC-DC
CONVERTER CONTROLLER OPTIMIZED WITH SWARM
INTELLIGENCE**

MICHAEL MATUI KANAI

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ABSTRACT

The use of DC-DC switched-mode power converters is continuously growing both in power electronics products and systems, e.g. in telecommunication applications, commercial grid systems among others. In a DC-DC converter application, it is always desired to obtain a regulated output voltage despite changes in input voltage, load current and converter components.

To obtain regulated output voltage, researchers have used conventional fixed gain PID controllers which suffer from the effects of sensitivity to disturbances and system non-linearity. To improve performance of the DC-DC converter controllers, intelligent controllers based on Adaptive Neural-Fuzzy Inference System (ANFIS) which does not need the exact mathematical model of the system has been designed by various researchers. These methods include: Gradient Descent (GD) and Hybrid method (combining Gradient Descent (GD) and Least Square Estimation (LSE)). In these methods, ANFIS controller's input membership function parameters are tuned and optimized by finding gradient of the error between input and output of the controller, then propagating it back into the controller. This usually slows convergence of controller parameters (membership functions shape and range) and can lead to convergence in local minimum.

In this research, Particle Swarm Optimization is proposed for tuning and optimization of ANFIS controller input membership function parameters so as to regulate output voltage of the DC-DC converter and improve its efficiency. Three categories of tests for the controller, namely, start-up, load regulation and line regulation, are carried out to evaluate the performance of the proposed control

system. Simulation results demonstrate that the proposed optimization method makes the controller parameters converge faster with smallest root mean square error (RMSE). Also the controller realizes a better output voltage tracking with minimal overshoot, small steady state error, short settling time and improved converter efficiency.