

# Modeling and Analysis of AC-DC Converter PID Controller Optimized with Pattern Search Algorithm

*Kanai, M. M, Nderu J. N., and Hinga, P.K.*

*Department of Electrical and Electronics Engineering, Jomo Kenyatta*

*University of Agriculture and Technology*

*P.O. Box 62000 Nairobi.*

*cheptora@yahoo.com, jnnderu@yahoo.com, pkhinga@yahoo.com.*

## Abstract

The paper presents a tuning methodology for the parameters of a PID controller in a three phase Pulse Width Modulation (PWM) Three-Level ACDC converter system, often referred as Improved Power Quality Converters (IPQC). A PID Controller is a generic control loop feedback mechanism (controller) widely used in industrial control systems. A PID controller calculates an "error" value as the difference between a measured process variable and a desired point. Three-phase Three-level AC-DC converters have been developed to a matured level with improved power quality in terms of power-factor correction, reduced total harmonic distortion at input ac mains, and regulated dc output. However, for best performance, the PID parameters used in the calculation must be tuned according to the nature of the system – while the design is generic, the parameters depend on the specific system. The parameters of converter, which vary with the operating conditions of the system, are adapted in order to maintain desirable response for output voltage and power factor. A Pattern Search Optimization (PSO) algorithm is employed in order to obtain the controller parameters assuring improved response at selected load. The Three-level AC-DC converter PIDPSO controller is modeled in MATLAB environment. The response of the developed controllers is compared to that of the controller whose parameters are tuned using the well-known Ziegler-Nichols method. The developed method is more proficient in improving the controller loop settling time, the rising time and overshoot and hence the disturbances do not affect the performances of Three-Level AC-DC converter.

**Keywords:** PID controller, Pulse Width Modulation (PWM), Three-Level AC-DC converter, Pattern Search Optimization (PSO) algorithm, Improved Power Quality Converters (IPQC).