



# Power Quality Enhancement in Residential Small Grids Through Power Factor Correction Stages Using Fuzzy Based Pi-Controller

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## ABSTRACT

*The proliferation of non-linear loads and the increasing penetration of Distributed Energy Resources (DER) in Medium-Voltage (MV) and Low Voltage (LV) distribution grids, make it more difficult to maintain the power quality levels in residential electrical grids, especially in the case of weak grids. Most household appliances contain a conventional Power Factor Corrector (PFC) rectifier, which maximizes the load Power Factor (PF) but does not contribute to the regulation of the voltage Total Harmonic Distortion (THDV) in residential electrical grids. This manuscript proposes a modification for PFC controllers by adapting the operation mode depending on the measured THDV. As a result, the PFCs operate either in a low current Total Harmonic Distortion (THDI) mode or in the conventional resistor emulator mode and contribute to the regulation of the THDV and the PF at the distribution feeders.*

**KEY WORDS:** Power Quality, Active Power Filter, Fuzzy Controller and Smart appliances.

## 1. INTRODUCTION:

In order to ensure efficient and proper operation of the grid-connected equipment, such as generators, loads, and storage systems, harmonic limits are specified by international standards and grid codes for AC electrical networks. There are restrictions on individual harmonics as well as current Total Harmonic Distortion (THDI) and current Total Demand Distortion in IEEE 519- 2014, a recommended practise and requirements for harmonic control in electric power systems [1]. (TDD). If highly nonlinear loads are connected, the

recommended THDV limits in electrical distribution feeder tap points will likely be exceeded due to the strong relationship between voltage and current harmonic distortion levels [2]. In weak or critical electrical power systems, exceeding voltage or current harmonic limitations affects overall efficiency and may result in critical problems (EPS).

Harmonic distortion causes induction motor heating [3], insulation accelerated ageing [4], and harmonic resonances in capacitors for compensating reactive power, among other things. Medical equipment could be harmed by harmonic distortion [3] and