GRUPO DE INVESTIGACIÓN ELECTROTECNIA Y ELECTRÓNICA LA RÁBIDA (GEYER)

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# Assessment of Harmonic Distortion Sources in Power Networks with Capacitor Banks


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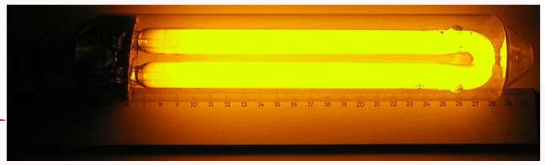
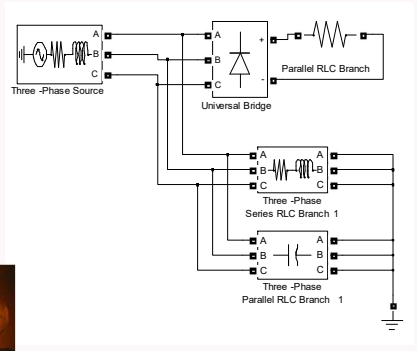
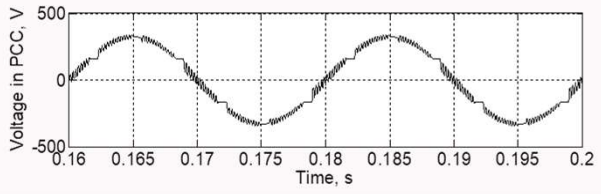
**ABSTRACT.** The identification of distortion sources in a power system is a topic unsolved. The problem has a difficult solution because there are elements in the system that do not produce harmonic but amplifies the existing in the electrical network. The most common of those elements is the capacitor, very used to compensate power factor at fundamental frequency. The capacitor behavior makes that the indices proposed up now to identify distortion indices fail in the presence of this element. In this paper, a new one is presented: the load characterization index. Besides using an extended equivalent circuit to represent the load, this index calculates the distortion introduced by the load, evaluating, besides the current distortion at its input, the voltage distortion at its terminals. The introduction of voltage assessing makes the index suitable to identify the linear and non-linear loads in the power system even in the presence of capacitors.

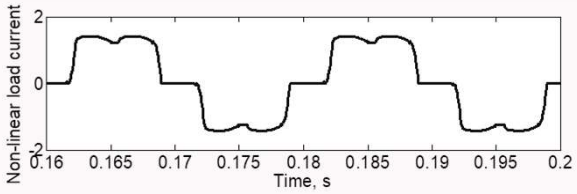






## Simulation results

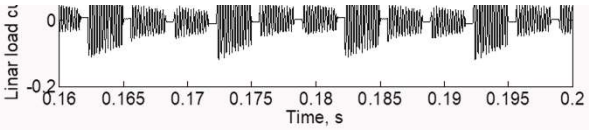



Voltage on PCC




Current at non-linear load input

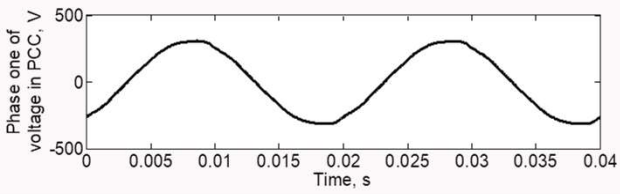
HGI = 27.17 NL = 27.81 LCI = 27.62



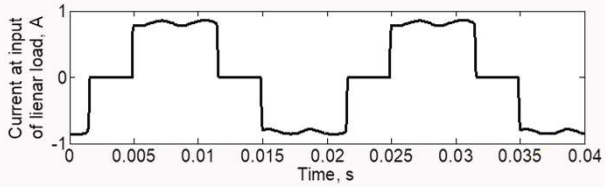

Current at linear load input

HGI = 5.00 NL = 99.69 LCI = 0.00

## Experimental results

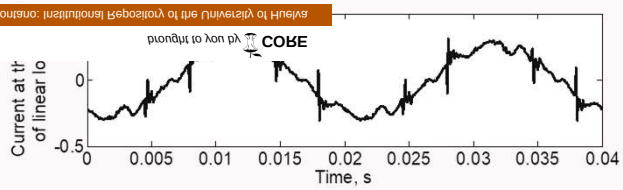



Voltage on PCC




Current at non-linear load input

HGI = 19.12 NL = 29.08 LCI = 28.64




Current at linear load input

HGI = 8.23 NL = 20.49 LCI = 0.00



## CONCLUSIONS

In this paper the main problem within the identification of distortion sources in a power system is analized: the presence of capacitors. The problem has been identified and studied in several papers in the Literature. In particular, it has been shown that the indices proposed up now fail in the presence of capacitors because they specify linear loads as distortion sources. In this paper the load characterization index (LCI) is presented. It is able to distinguish the linear and non-linear loads. Thus, the non-linear are considered the only responsible for the distortion present at the point of common connection. This index has been applied to simulation and experimental systems. The results obtained in both, confirm the validity of the new index proposed in this paper in the presence of capacitors.

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