Abstract: This thesis proposes identifying approaches and recognition of current harmonics that are based on machine learning strategies. The approaches are applied directly in the quality improvement devices of electric energy and in energy management solutions. Complete neural structures, equipped with automatic learning capabilities have been developed to identify the harmonic components of a sinusoidal signal at large and more specifically an AC disturbed by non–linear loads. The harmonic identification is performed with multilayer perceptron neural networks (MLP). Several identification schemes have been developed. They are based on a MLP neural network composed of linear or multiple MLP networks with specific learning. Harmonics of a disturbed signal are identified with their amplitude and phases. They can be used to generate compensation currents fed back into the network to improve the waveform of the electric current. Neural approaches were developed to distinguish and to recognize the types of harmonics and is nonlinear load types that are at the origin. This consists of an MLP network functioning as a classifier that learns the harmonic profile of several types of predetermined signals and representative of non–linear loads. This entry uses the parameters of current harmonics as well as indicators on the general form of the current wave. Learning can recognize the type of nonlinear load that generates disturbances in the power network. All harmonics identification and recognition approaches have been validated by simulation tests or using experimental data. The comparisons with other methods have demonstrated superior characteristics in terms of performance and robustness.

Keywords: Multilayer Perceptron; Machine Learning; Artificial Neural Networks; Classification; Current Harmonic Identification; Nonlinear Loads; Power Quality; Electrical Appliance.

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