

## **ABSTRACT**

According to the importance of protection relays in maintaining the continuity supply of electricity to consumers, many researchers have investigated the performance of these protective relays and all problems regarding its behavior during different transient events in the electrical power system. Some of these problems are related to the wrong setup of the protection devices, while others result from the electromagnetic interference of the power system elements with the protective devices. Any deviation of the basic electrical values frequency, voltages, and current from their nominal values is called poor power quality. power poor quality can cause disturbances of protective relays performance which leads to an incorrect decision in isolating the faulted zone or the faulted element, and sometimes this incorrect decision may cause a blackout. In this thesis, we have defined all the elements of this thesis and then linked them for the deeper understanding of the subject of the research and to achieve all the desired results, which is understanding and showing the effect of poor power quality on digital relays. In order to understand the first element of this thesis, which is the power quality, we have reviewed all the problems that lead to this problem according to the different international standards, and then we have conducted a set of practical measurements and compare them with the international standards for a deep understanding of this concept. The second element of this thesis, which is the digital relays, was presented in detail through practical measurements and modelling where the components of digital protection were explained in a way that meets the purpose of the research and serves future research related to this subject. Then the first and second elements were linked through two methods, the first method is to study the impact of poor power quality on a single protective relay element while the second is to study the effect of poor power quality on an entire power system containing different protection elements and different voltage levels and various electrical elements. A range of practical and mathematical solutions have been proposed and investigated and these solutions will be the nucleus of future research work for many researchers.