Wrocław, 16 March 2020

Abstract of the doctor's thesis by Tomasz Biernacik, MEng, titled:

**"A method for determining the maximum value of a selected current harmonic of a passive filter employed in an industrial power supply network".**

The goal of the present thesis is to systematize and expand knowledge on certain issues related to limiting the impact of non-linear loads on the power supply network by means of passive higher-harmonic filters. The thesis consists of twelve chapters and includes a list of references. In the thesis, we consider one of the most important problems encountered in the design of passive filters, namely, how to determine the maximum current of the eliminated harmonic that can flow through a two-terminal series LC circuit connected in parallel to a network prior to its application in the network in question and how to assess the probability of its occurrence. In the thesis, we discuss a number of methods of network analysis described in the literature. They have been chosen from the point of view of their suitability for calculating voltage distortions at specific points in a power supply network. We also discuss modelling methods that are fitted for mapping both simple and complex network topologies. In the thesis, we describe selected methods of iterative computation and innovative methods employing genetic algorithms or artificial neural networks. The thesis contains an analysis of selected models of power supply networks optimized to facilitate the design of higher-harmonic filters for different operating conditions, with special attention to the variability and diversity of loads. After specifying the goal, scope and proposal of the doctoral thesis, we move on to discussing original field tests conducted at industrial plant power networks with load characteristics that meet the criteria assumed. Next, we present an analysis of the test results. An original method of calculating the maximum values of current harmonics in a passive filter is proposed. On the basis of mathematical dependencies we have derived, an algorithm has been built for analysing test data. A computer program has been developed that facilitates the processing of large amounts of data obtained as part of field measurements. A statistical analysis has been carried out in order to determine the frequency of occurrence of the maximum values of selected filter current harmonics calculated using the algorithm and the computer program developed as part of our research. A procedure for the verification of results obtained using the method developed by the author is described.

Verification was performed by comparing the results of the field tests of experimental passive filters with the results obtained by using the algorithm and computer program developed for the calculation of the maximum current value of the higher harmonic in a passive filter. On the basis of the results obtained from the field tests and their analysis as well as of the results of calculations and simulations performed by the methods developed by the author of the present thesis, we formulate conclusions and proposals for the possible uses of the method we have developed.

Tomasz Bieniek.