Abstract of the doctoral dissertation

"Topological indices in the graph theory"

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This paper is dedicated to topological indices in the graph theory. Author describes Wiener index, indices originated from the Wiener index (modified Wiener index, Wiener polarity index, hyper-Wiener index) and indices related to eccentricity, in particular adjacent eccentric distance sum index and eccentric distance sum index. Those indices have a wide application in different fields of science, for example chemistry and genetics. There are a lot of very interesting papers in the literature concerning topological indices, as many authors were interested in this subject.

This disseration is divided into three chapters. In the first chapter there are introduced the necessary markings and definitions.

The second chapter concerns Wiener index and indices originated from the Wiener index. All indices have been defined and there were described some interesting results in this field. The further part of this chapter concerns generalized Wiener polarity index for which there is described a general case of its maximal values for 2-trees with some special assumptions. There were also given some examples of maximal 2-trees.

The generalized Wiener polarity index of a graph $G = (V(G), E(G))$ is a number of unordered pairs of vertices u, v of G such that the distance between u and v is equal to k.

The third chapter concerns indices related to eccentricity. In particular the are described: adjacent eccentric distance sum index and eccentric distance sum index.

Adjacent eccentric distance sum index is defined as below

$$\xi^{sv}(G) = \sum_{v \in V(G)} \frac{\varepsilon(v)D(v)}{\deg(v)}.$$

In the section concerning this index there are some theorems proved that shows upper and lower bounds. Moreover, there are some results given for the index value depending on

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different parameters. There are also graph transformations described and their influence on the index values.

Section concerning eccentric distance sum index is showing a lower bound for this index. There are properties for cactus shown and also for some other class of graphs. Eccentric distance sum index is defined as

$$\xi^d(G) = \sum_{v \in V(G)} D(v)\varepsilon(v)$$

All results are ilustrated with some examples and pictures which are here to facilitate the understanding of the subject.

Selected papers below.

1. H. Bielak, K. Broniszewska, *Eccentric distance sum index for some classes of connected graphs*, Annales UMCS, Sectio A, Vol. 71, No 2, 2017, 25–32, doi: http://dx.doi.org/10.17951/a.2017.71.2.25

2. H. Bielak, K. Dąbrowska, K. Wolska, *On the generalized Wiener polarity index for some classes of graphs*, Proceedings of the Federated Conference on Computer Science and Information Systems, 483–487, DOI. 10.15439/2015F340, ACSIS, Vol. 5.

3. H. Bielak, K. Wolska, *On the adjacent eccentric distance sum of graphs*, Annales UMCS, Sectio A, Vol. 68, No 2, 2014, 1–10, doi:10.1515/umcsmath-2015-0001.

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