**Centrality in Network Structures and its Properties**

*Abstract*

Today networks are used to represent socio-economic processes, human relations, biological and physical processes. Usually the main and probably the first problem studied in networks analysis has been the detection of the most important elements in a network. Unfortunately, there is no universal definition for the centrality; consequently, there have been proposed diverse approaches to the problem. There exist various centrality measures for nodes as the concept of a central element varies based on the graph nature. Some centrality measures consider the local neighborhood of a node (e.g.: degree centrality) while other measures consider the shortest paths that go through a particular node (e.g.: closeness and betweenneess centralities), random walks (PageRank centrality), the importance of the neighbors (e.g.: eigenvector, Katz or Bonacich centralites), etc. Since centrality in networks is an ill-defined problem, there is also no clear guideline on how to assess the performance of different methods. Thus, the main goal of the study is to perform a detailed study of properties of existing centrality measures.

We perform a comprehensive overview of existing axioms for centrality that measure the "rationality" of classical centrality measures and examine their stability on various classical graph structures (random graphs, small-world graphs and lattice graphs). The stability of centrality measures is performed in order to understand how the set of central nodes is changed due to various changes in the graph structure (addition/removal of nodes/edges). Additionally, we examine the impact of countries on international food trade network. As a results, we elucidated pivotal countries in the food network and evaluated how stable the network is, i.e. how quickly the set of central elements changes due to various changes in the network's structure.

The performed study is of great importance for the following reasons. Since these properties determine how stable and constant the final set of central elements is, it gives a more detailed perception of the main features, advantages and disadvantages of existing centrality measures. Furthermore, the results of the study can be used for the choice of appropriate centrality measure and for further development of new models.