NUMERICAL SIMULATION OF THE TOPOLOGICAL STRUCTURE OF THE COMPUTER NETWORKS

Oxana Koneva, *student*; Vadim Borisyuk, *senior teacher*

Complex networks describe a wide range of high-tech and intellectual importance systems. For example, the Internet - a complex network of routers and computers connected by various physical and wireless connections or the World Wide Web is a huge network of web pages related by hyperlinks [1].

In general, complex network is a structure formed by nodes (or vertices) and connecting links (edges). Usually it considered through adjacency matrix A with element a_{ij} equal *1* if nodes i and j are connected and *0* otherwise.

At the present time there are three basic concepts for real-world networks modeling: the model of random networks (Erdos-Renyi), the small-worlds model (Watts-Strogatz) and the Barabashi-Albert model. In proposed work, Barabashi-Albert procedure of preferential attachment has been used for modeling the structure of the Internet, as this concept takes into account the growth of the network with the lapse of time.

In analyzing of network topology, following statistical parameters have been used: average path length, clustering coefficient, and correlation profile [2]. All quantities were obtained by numerical calculation from the adjacency matrix of the simulated network. All pair shortest paths were obtained through bread-first search algorithm.

The topology of the Internet has been studied at the level of routers that are the vertices and edges - physical connections between them. Analysis of the structure and properties was carried out for networks with different initial number of nodes. It was found that independently of the initial number of network elements, in all cases was obtained by a power-law distribution function of the degrees of nodes.

1. M.E.J. Newman, *SIAM Rev.* **45**, 167 (2003).
2. R. Albert, A.-L. Barabasi, *Rev. Mod. Phys.* **74**, 47 (2002).