Conclusion

This monograph is devoted to researches in flow tasks in networks in fuzzy conditions. Approaches to maximum flow finding, the minimum cost flow finding in static and dynamic networks in terms of fuzziness and partial uncertainty are supposed. Decisions of these tasks allow to find the maximum cargo traffic between selected nodes on the road, identify the paths of transferring cargo of the minimum cost map and solve these tasks taking into account limited time horizon.

Extreme flow tasks in fuzzy conditions nowadays are poorly studied. Despite of the researches of foreign authors in the field of flows, there are unexplored issues related to flows finding, taking into account fuzzy nonzero lower flow bounds, arc capacities, transmission costs, crisp time parameters, depending on the flow departure times. The method of operating with fuzzy flows in the form of fuzzy numbers is proposed. This method uses the centers of fuzzy numbers and blurs the result at the final step of the algorithm. Nonstandard operation of subtraction is implemented in the method, as it doesn't lead to the strong blurring of the resulting number and negative flow values.

The new scientific results described in the present book are constructing of new mathematical models of extreme flow tasks in fuzzy networks and modification of the existed methods of the flow tasks solving. In particular, the following tasks are proposed in the monograph and illustrated by the numerical examples:

1. Methods of the maximum flow finding in the network with zero and nonzero lower flow bounds. These methods allow, despite of the existed, find the maximum flow with zero and nonzero lower flow bounds set in the fuzzy form.
2. Methods of the minimum cost flow finding in networks, which parameters are zero and nonzero upper, lower flow bounds and transmission costs that allow find the minimum cost flow with fuzzy upper, lower flow bounds and transmission costs.
3. Methods of the maximum flow finding in dynamic network with fuzzy zero and nonzero lower and upper flow bounds that differ from analogues that allow to take into account dependence of fuzzy lower and upper flow bounds from departure time.

A.V. Bozhenyuk et al., *Flows in Networks Under Fuzzy Conditions*,
Studies in Fuzziness and Soft Computing 346, DOI 10.1007/978-3-319-41618-2

4. Methods of the minimum cost flow finding in dynamic networks with fuzzy arc capacities and costs that differ from analogues that allow take into account dependence of fuzzy arc capacities and transmission costs from departure time.
5. Methods of the minimum cost flow finding in dynamic networks with fuzzy nonzero lower flow bounds and costs that differ from analogues that allow take into account dependence of fuzzy upper, lower flow bounds and transmission costs from departure time.
6. Program module implementing while finding fuzzy maximum flow with zero and nonzero lower flow bounds used with GIS ObjectLand.

Our future researchers lie in the field of flows finding in dynamic networks with given vitality degree and increasing of vitality degree in fuzzy networks.