Warsaw, March 31, 2023

mgr inż. Michał Guzek
Author
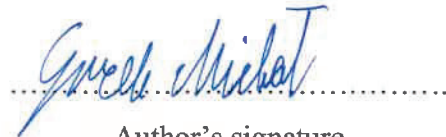
Abstract of the doctoral disertation entitled:

„System for the operational optimization of the Warsaw District Heating Network"

In the dissertation the operational optimization of a large ring heating network was presented. The described optimizer was implemented in the Warsaw Heating Network for the ongoing optimization of the network operation, i.e. planning the work in the horizon of 48 or 120 hours. The dissertation includes an overview of the approaches to modeling and optimization of district heating systems. The full methodology of building the system has been described – definition of the optimization task, selection of algorithms to solve it, building a network model, implementation and testing of the optimization system.

The optimizer plans the supply temperatures and supply pressures of 4 heat sources in different locations (with the possibility of switching off the source), and the supply and return pressures of the 3 boosting pumping stations. Implemented optimization algorithms, using the IPOPT library and unique heuristic algorithms are discussed. The optimization task uses numerous technical and contractual constraints, implemented partly as hard and partly as soft constraints. The most important distinguishing feature of the work is the use of machine learning to build a model of the heating network, based mainly on historical measurement data, and not on the physical properties of the network. Historical data were supplemented with data from the network simulator. The method of building individual elements of the network model was described. The author also presented the methodology of testing of the created system and the results of tests carried out during its development and implementation.

Keywords: district heating network, district heating system, operational optimization, mathematical modeling, machine learning.

Author's signature