

Each solution is evaluated using a fitness function that combines the optimization criteria. The best solutions are selected and refined through successive iterations, improving the population over time. The model is tested using hypothetical data to verify its performance, and a sensitivity analysis assesses how changes in input parameters, such as fuel prices or demand, affect the results.

Finally, the model is evaluated for optimality. If the results are not satisfactory, further refinement is done until an optimal solution is found.

By breaking down the process into distinct stages, the flow chart approach facilitates the identification and resolution of potential issues in the model's development. It also provides an organized way to evaluate different optimization criteria — such as cost, reliability, flexibility, and sustainability — in an integrated manner. The clear, step-by-step approach enhances the transparency and reproducibility of the research, allowing for more effective adaptation of the model to specific conditions and requirements within the transport logistics sector, such as those in the "Lisky" intermodal transport branch.

References:

1. Price, K. V., Storn, R. M., & Lampinen, J. A. *Differential Evolution: A Practical Approach to Global Optimization*. Springer, 2005.
2. Головка Т. В., Демченко І. С. Модель планування інтермодальних перевезень за допомогою алгоритму диференціальної еволюції. IV Міжнародна науково-практична конференція «Trends in the development of science as the main way to replace old technologies», 27-29 січня 2025 р., м. Пловдив, Болгарія. 227-233 с.
3. Replit. URL: <https://docs.replit.com> (дата звернення: 13.03.2025).
4. Центр транспортного сервісу “Ліски” URL: <https://liski.uz.gov.ua> (дата звернення: 16.03.2025)

METHODS OF MONITORING LANDS OF HISTORICAL AND CULTURAL SIGNIFICANCE

IVAN DEMOCHKO, PhD student

SERHII G. NESTERENKO, Associate Professor, PhD in Engineering, Scientific Adviser.

OLENA L. ILIENKO, Professor, Doctor of Science in Education, Language Adviser

O. M. Beketov National University of Urban Economy in Kharkiv

Monitoring lands of historical and cultural significance is a key element in preserving cultural heritage. It includes a set of measures aimed at assessing the condition of objects, identifying potential threats, and developing strategies for their protection.

Main Monitoring Methods:

1. *Engineering and Geodetic Methods:*

These methods provide high-precision measurements to detect deformations in buildings and structures. For example, in the research of S. M. Zavorotny, the practical experience of creating a network of control points for periodic monitoring of deformations of historical buildings in the city of Wrocław was examined. This allows for timely detection and response to changes in the structure of objects [1].

2. Geophysical Methods:

These include magnetic prospecting, ground-penetrating radar (GPR) surveying, and electrical resistivity tomography. These methods allow for non-contact exploration of underground structures and the detection of archaeological objects without disturbing the soil. For instance, GPR surveying is effectively used to locate buried objects and study the stratigraphy of monuments [2].

3. Remote Sensing and Geographic Information Systems (GIS):

The use of aerospace imaging data and GIS technologies allows for large-scale monitoring of territories. This is especially relevant for large objects or areas with limited access. Such technologies provide rapid detection of changes and potential threats to cultural heritage objects.

4. Photogrammetry and 3D Modeling:

These methods enable the creation of precise three-dimensional models of objects, facilitating detailed analysis of their condition and planning of restoration works. Photogrammetric methods are particularly valuable for documenting historical landscapes and archaeological sites, ensuring their preservation for future generations [3].

5. Laser Scanning (LiDAR):

LiDAR technology provides high-precision scanning of the earth's surface and objects, allowing for the detection of even minor changes in the structure of monuments. This contributes to the creation of detailed digital models that can be used for analysis and planning conservation measures.

6. Monitoring of Cracks and Deformations:

An important aspect is the observation of crack expansion in buildings of historical and cultural significance. The use of specialized instruments and techniques allows for the recording of even the smallest changes, which is critical for timely intervention and preventing the destruction of objects.

7. Analysis of Historical Data and Mapping:

The use of historical maps and documents in combination with modern technologies helps to identify and study objects that have been lost or forgotten. This contributes to the restoration of historical memory and the integration of newly discovered objects into the modern cultural landscape.

A comprehensive approach to monitoring lands of historical and cultural significance, combining different methods, is the key to effective protection and preservation of cultural heritage. Modern technologies significantly improve the accuracy and efficiency of monitoring activities, assisting in detection and elimination of potential threats to historical and cultural sites in a timely manner.

References:

1. Zavorotny S.M. Analysis of modern engineering and geodetic monitoring methods for buildings and structures of historical and cultural heritage. Technical Sciences and Technologies. 2024. No. 3 (37). pp. 228–235.
2. Geophysical Methods for the Study of Historical and Cultural Heritage. Innovative Projects of Taras Shevchenko National University of Kyiv. URL: scp.knu.ua
3. Chetverikov B. V. Photogrammetric Methods in the Study of Lands of Historical and Cultural Significance: Guest Lecture for Land Management Students. National University of Life and Environmental Sciences of Ukraine. 2024.

MODERN CHALLENGES IN POLYMER MATERIAL PRODUCTION BY EXTRUSION: TECHNOLOGICAL INNOVATIONS

VLADYSLAV DENYSIUK, PhD student

VITALII DENYSIUK, PhD student

MYKOLA P. SHVED, Associate Professor, PhD in Technical Sciences, Scientific Adviser

SVITLANA M. MOISEIENKO, Associate Professor, PhD in Philology, Language Adviser

National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute»

The production of polymer materials by extrusion is extremely important in the industry, as it enables the manufacturing of a wide range of products – from films and fibers to rigid structural materials. Despite being a well-developed method, modern market trends require its improvement due to the need for increasing production efficiency, reducing energy consumption, and ensuring environmental safety. Moreover, the demand for polymers with enhanced mechanical and physicochemical properties is growing, posing new challenges in the field of extrusion.

One of the key challenges is the uniform mixing of additives, particularly pigments and fillers, in the polymer melt. The presence of pigment agglomerations or the uneven distribution of fillers significantly affects the quality of the final product, causing issues with mechanical properties and appearance. Another serious issue is the viscosity of the polymer melt, which determines the extrusion process speed and the uniformity of material flow through the extrusion head. Improper rheology can lead to surface defects, loss of product strength, or even deformation of the extruder due to excessive pressure [1].

Another significant aspect is equipment wear, which becomes particularly pronounced when processing filled polymer blends or composites. The wear of the screw and the extruder walls leads to material losses, changes in process parameters, and increased maintenance frequency. Additionally, the high energy consumption required to maintain the melt temperature and perform mechanical processing of the material poses a challenge for manufacturers to improve energy