

# Faculty of Architecture, Construction and Design

Department of Applied Mathematics and Mechanics

Department of Building and Civil Engineering

Department of Architecture and Design

Department of Electrical Engineering





# ASSESSMENT OF THE OPERATIONAL CONDITION OF ELECTRICAL EQUIPMENT AND ELECTRICAL NETWORKS BY THERMAL IMAGING

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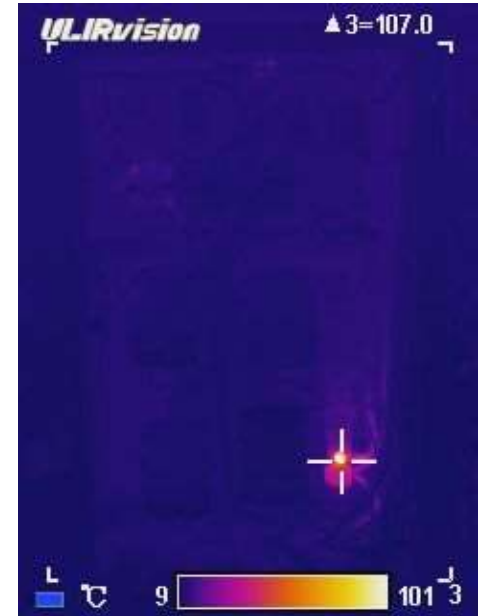
The use of this method to control the condition of electrical installations has a number of significant advantages, in particular in determining and monitoring:

- permissible heating temperature of electrical equipment elements and conductors;
- exceeding the permissible temperature;
- excessive heat transfer;
- defect rate;
- condition of similar equipment.

This approach allows timely detection of defects in contact connections, overloading of lines and devices, prevention of damage to the insulation of any electrical equipment, and thus prevents possible emergencies: power outages, fires, and destruction of electrical installations. It is also possible to predict the development of emergencies and assess the reliability of electrical equipment.



Actual condition of the floor metering panel in an apartment building



Thermogram of a given panel with a problem area with a temperature of 101 °C (loose contact, overload)



# PREDICTION OF ELECTRICITY CONSUMPTION BASED ON AZURE MACHINE LEARNING AND IMPLEMENTATION OF A TECHNICAL MONITORING SYSTEM

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The aim of the work is to develop a method and model for assessing and identifying ways to reduce the cost of electricity consumed by consumers on the example of refrigeration units.

The subject of the study is the forecasting of electrical loads of electricity consumers based on the construction of a technical monitoring system and the use of artificial intelligence tools of the Microsoft cloud platform - Azure, which provides the ability to develop, execute programs and store data on servers located in distributed data centers.

The practical significance of the results obtained is that, based on the proposed models and methods, algorithms for assessing energy efficiency and obtaining a short-term forecast of energy consumption for planning the volume of electricity purchases made through:

- building a test model for predicting electricity consumption using a machine learning system, based on data collected from the most energy-intensive equipment of the customer (in our case, refrigeration units);
- determination of the required list of subsystems and the final architecture of the software and hardware complex of the forecasting system to ensure successful forecasting of the electricity consumption process.



Monitoring of parameters and forecasting of electricity consumption and payment for consumed electricity in accordance with the tariff



# Smart energy management for the sustainable development of the city: information technology for comprehensive monitoring of the energy efficiency of water supply systems and their facilities

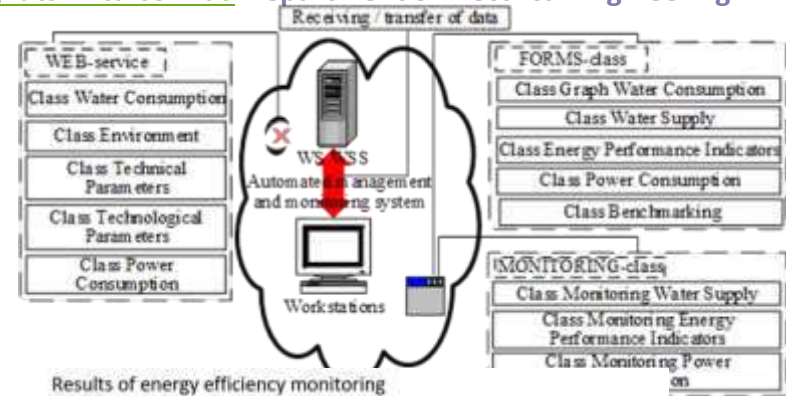
Liudmyla Davydenko, e-mail: [l.davydenko033@gmail.com](mailto:l.davydenko033@gmail.com), [l.davydenko@lutsk-ntu.com.ua](mailto:l.davydenko@lutsk-ntu.com.ua) Department of Electrical Engineering

## Tasks to be solved to improve the energy efficiency of the system and its objects:

- Formalization and identification of cyclical changes in water consumption
- Energy consumption planning taking into account changes in water consumption
- Monitoring of energy consumption efficiency
- Energy efficiency benchmarking

## The result of functioning:

- Formation of typical profiles of water consumption and a set of their characteristics
- Planning the operation mode parameters of water supply facilities
- Determination of the energy baseline and the daily profile of energy consumption
- Identification of deviations from the planned indicators and their causes
- Formation of energy efficiency benchmarks taking into account the actual level of energy efficiency



Results of energy efficiency monitoring

Date	Deviation of technological parameters from control/warning limits	Identification of the reason	Notification
01.02	0 / 0	0 / 0,00	Increase of efficiency is possible
04.02	+85,1 / +1103,67	+0,21 / +0,30	Discrepancy to the planned mode
05.02	0 / -141,67	-0,13 / -0,22	Discrepancy to the planned mode
06.02	0 / 0	0 / 0	Parameters are within normal limits
07.02	0 / 0	0 / -0,09	Increase of efficiency is possible
08.02	0 / 0	0 / 0	Parameters are within normal limits
11.02	0 / +1,7	+0,26 / +0,35	Increase in ΔH Decrease of efficiency
12.02	0 / 0	0 / +0,05	Parameters are within normal limits
13.02	0 / -1,31	0 / 0	Parameters are within normal limits
14.02	0 / +15,71	0 / +0,05	Increase in Q Decrease of efficiency is possible
15.02	0 / +117,67	0 / 0	Decrease of efficiency is possible
16.02	0 / 0	0 / 0	Parameters are within normal limits
19.02	0 / 0	0 / 0	Parameters are within normal limits
20.02	0 / 0	0 / 0	Parameters are within normal limits
21.02	0 / 0	0 / 0	Parameters are within normal limits
22.02	0 / -145,6	0 / 0	Decrease of efficiency is possible
25.02	0 / 0	0 / 0	Parameters are within normal limits
26.02	-0 / 0	0 / -0,04	Increase of efficiency is possible
27.02	0 / -67,67	0 / 0	Parameters are within normal limits
28.02	0 / -106,67	0 / +0,04	Increase in ΔH with decreasing Q Decrease of efficiency

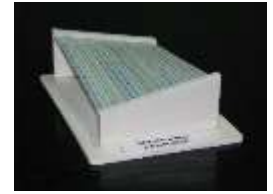


# DEVELOPMENT AND CALCULATION OF TRANSFORMABLE FORMWORK STRUCTURES FOR THE CONSTRUCTION OF MONOLITHIC SHELLS DEFINED ALONG THE SURFACES OF DOUBLE CURVATURE OF COMPLEX SHAPE

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Algorithms and software for the automated formation of models of reinforced concrete shells of double curvature according to the specified geometric parameters of the flooring elements have been developed.

The proposed algorithms and the design of the formwork shield (which is protected by a patent) make it possible to simplify, unify, and significantly reduce the cost of designing and constructing reinforced concrete shells.





# IMPROVEMENT OF TRIBOSTATIC POWDER COATING TECHNOLOGY USING GEOMETRIC METHODS OF FRACTAL DIAGNOSTICS OF COATING QUALITY

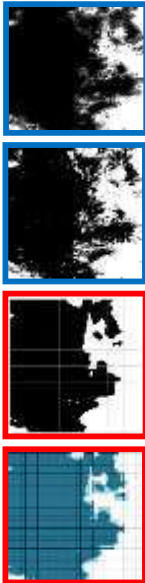
Serhii Pustiulha, Department of Architecture and Design,  
Volodymyr Samchuk, e-mail: volodsam@ukr.net, Department of Building and Civil Engineering

A proprietary methodology for fractal measurement of the quality of powder adhesion on grounded painted surfaces has been developed, which allows for effective control of the technological parameters of powder deposition.



The design of a universal tribo gun sprayer is proposed, which allows, due to specially developed technical equipment and the corresponding method of its application, to control the process of tribo charging of powder paints of different dispersion, humidity, and material.

The parameters that allow to describe the degree of charging of powder paint particles in tribostatic systems are determined. The geometry of powder paint particle movement in the channel of a fixed dielectric gun cylinder was studied, the multiple contact of powder paint particles with the inner surface of the cylinder was analyzed, the optimal distance between the sprayer and the product during painting was determined, and the temperature conditions for the spraying process were proposed. The results became the basis for the development of an innovative methodology for assessing the quality of powder coating processes.

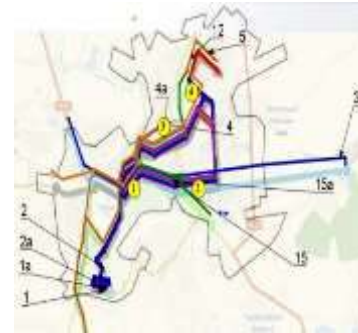
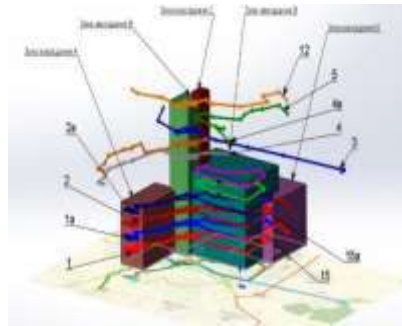




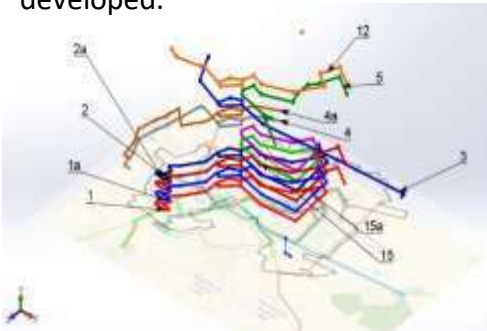
# A METHOD OF FRACTAL ESTIMATION OF THE OVERLAP INDICATOR OF ROUTE SCHEMES FOR OPTIMIZATION OF URBAN PASSENGER TRANSPORTATION

Serhii Pustiulha, Department of Architecture and Design,  
Volodymyr Samchuk, e-mail: volodsam@ukr.net, Department of Building and Civil Engineering

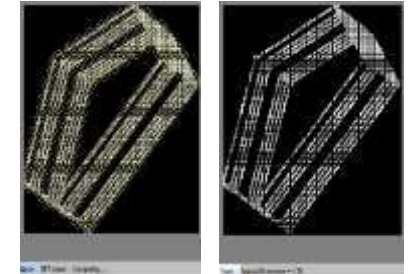
The main features of the functioning of urban passenger transportation are investigated and the influence of the characteristics of transport systems on the determination of indicators of route overlap is revealed. The method of 3D representation and automated zoning of urban trolleybus routes is developed.



A method for fractal estimation of the degree of route overlap in certain zones and ways to improve the transport operation of vehicles on routes at different times of the day are proposed.



The paper proposes approaches to the dynamic reservation of trolleybuses on routes, which will ensure effective modification of route schemes, prompt adjustment of the trolleybus schedule on the network, time standards for running flights, systems of labor organization of drivers, and the combined mode of trolleybus traffic.





# DEVELOPMENT OF CONCRETE COMPOSITION WITH THE USE OF ECOLOGICAL ADDITIVE BIOPLAST

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Biotechnological plasticizer "Bioplast-1":

- corresponds to plasticizing additives according to DSTU B V.2.7-171;
- causes an increase in the mobility of the concrete mixture by two degrees - from P1 to P3 (from 3-4 cm to 13-14 cm);
- contributes to the growth of concrete strength with the addition of up to 20%;
- reduces the water consumption of the concrete mixture by up to 18% and maintains the specified mobility;
- helps to increase the density of cement stone, which increases the frost resistance of concrete by at least 100 cycles.

Advantages of using a plasticizer:

- saving of cement;
- increasing the final strength characteristics of the structure;
- reducing the stiffness of the concrete mix - its dilution;
- reduction of energy and labor costs when placing concrete in the formwork of monolithic structures.

The plasticizer is made on the basis of environmentally friendly biopolymers, which are formed by beneficial, safe microorganisms - cellulose type and other biocomponents.







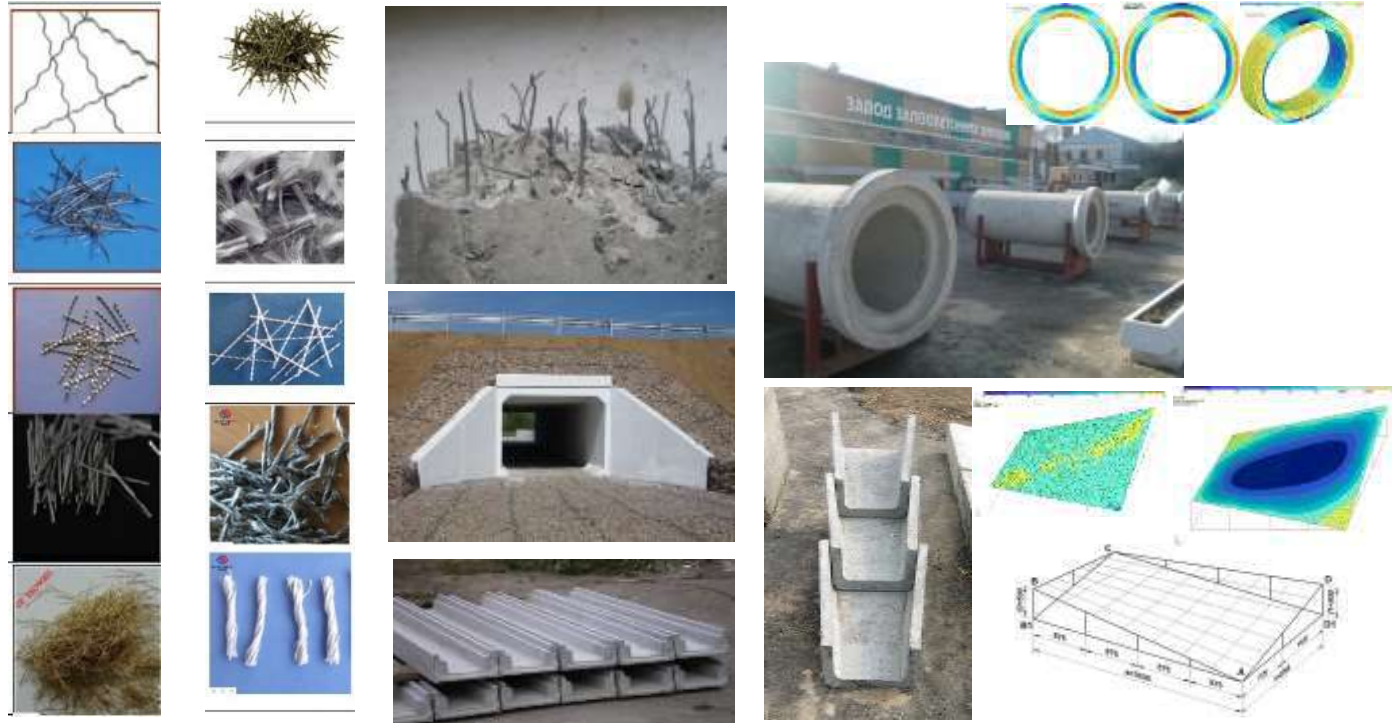
# DEVELOPMENT OF ROAD STRUCTURES AND RIGID PAVEMENTS ON HIGHWAYS USING DISPERSED REINFORCEMENT

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Calculation and design of building structures using dispersed reinforcement.

The main advantages of using dispersed reinforcement are:

- strengthening of the material (allows to increase their load capacity)
- reduction of weight and volume;
- corrosion resistance;
- design and flexibility;
- energy efficiency.





# DESIGN OF STRUCTURES USING COMPOSITE REINFORCEMENT

Oleksandr Chapiuk, e-mail: ochapyuk@ukr.net, Department of Building and Civil Engineering

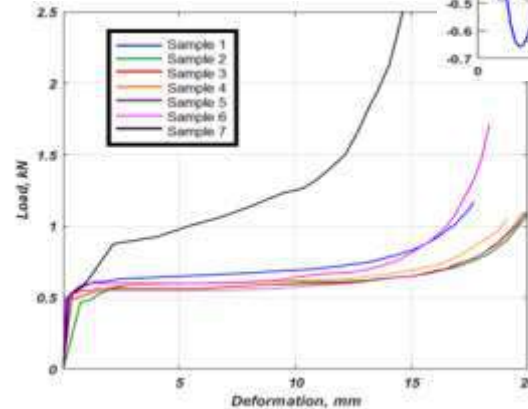
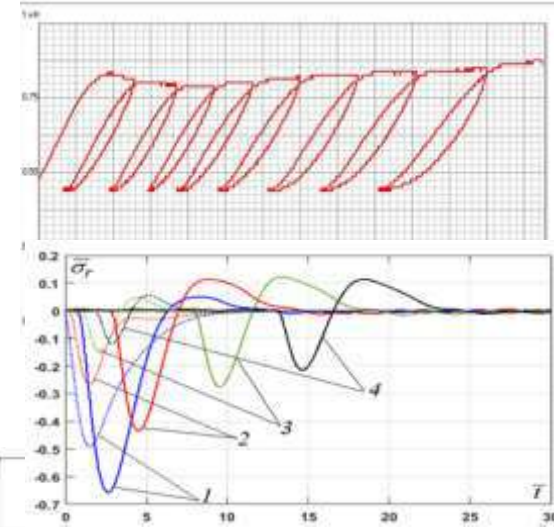
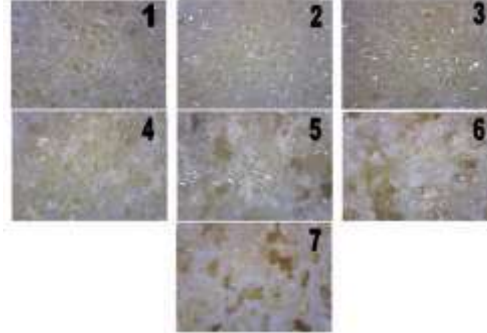
Calculation and design of building structures using composite reinforcement:

- composite reinforcement (instead of steel) of concrete roads with continuous reinforcement;
- elements of road bridges;
- external concrete reinforcement of structures by shotcrete;
- reinforcement of concrete road slabs for problematic cases (waterlogged soils, heterogeneous, weak foundations).

The main advantages of using composite reinforcement:

- high corrosion resistance;
- durability;
- environmental friendliness;
- transportability;
- low weight.





- ❑ Simulation in the mechanical behaviour of structurally heterogeneous materials
- ❑ Experimental data analysis of structurally heterogeneous materials
- ❑ Research methods optimization of mechanical characteristics of materials



## Design and piloting of UAVs

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Production of UAVs.

Training of pilots with  
issuance of  
certificates.

Development of new  
types of UAVs.

