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Conception of finite elements for calculations of constructions with large stiffness changes

An original conception of finite elements with adjustable shape functions, depended of local changes of stiffness in sub-areas of the calculated construction model, is presented in the paper. Presented solution is called as elements with adaptive shape functions, because described by them deformation field can be modified during the calculation process, according to local changes of stiffness. This conception can also be used for solving problems, where the local stiffness differences are the initial state. Examples of such solutions are presented in the paper. Performed computational studies show the validity of the concept and lead to correct solutions. The main advantage of the presented method is the reduction of finite elements number and the reduction of time-consuming procedures for reorganization the system geometry.

Artur DUCHACZEK, Zbigniew MAŃKO

Impact of size of assembly holes on effort of DMS-65 type assembled bridge transom

The author of the paper conducted a strength analysis of a cross-beam in a DMS-65 type assembled bridge with regard to the assessment of the impact of the size of assembly holes on its effort. In the analyses the finite element method (FEM) was employed, modelling the transom as a monocoque construction with the use of surface elements. It transpires from the conducted analysis that the existing assembly holes of 200 mm in diameter are not an optimum solution of that construction.

Dorota KRAWCZYK, Urszula ŻYŁKIEWICZ

The analysis of different energy sources for the building of Culture and Sport Centre

The article presents the comparison of three heat sources working for the public building. An economic analysis, including estimation and comparison of investment and operating costs for selected solutions was done. Moreover technical feasibility and environmental problems were discussed.

Małgorzata LELUSZ

Evaluation of reactive SiO₂ content in fly ashes from power plants in north-eastern Poland

In the presented paper the results of field-laboratory investigation concerning the fluctuation in reactive SiO₂ content in fly ashes from power plants in north-eastern Poland. Experiments were conditioned on the basis of the SiO₂ content evaluation depending on two factors: the fly ash source (factor *A*) and the reception sample period (factor *B*). The use of variance analysis in evaluating the collected data allowed to conclude that both of the considered factors significantly influenced the fly ashes SiO₂ contents. The fly ashes were monitored during seven months of the 2010/2011 heating season. The influence share of factor *A* was 64% whereas for the case of factor *B* it was 7%. This means that factor *B* influences less that factor *A*.

Joanna PIOTROWSKA-WORONIAK, Grzegorz WORONIAK

The energetical, economical and ecological effects of the hotel building thermomodernization in Białystok

In the hotel, built in the years 1973-1975, characterized by a high rate of annual heat demand for heating (342.84 kWh/m²year), a complex thermal modernization of the body building, the heating system and warm water one and a heat source were performed. The annual energy performance, as well as economical and ecological effects were determined, that can be obtained as a result of these improvements. The range of thermomodernization works carried out of the body building and modernization of the proposed technological solution using the old oil boiler to support renewable energy hot water heating were presented.

Jerzy SEKOWSKI, Magdalena GAWLIK

School building foundation according to Polish standards: PN-59/B-03020, PN-81/B-03020 and PN-EN-1997-1

A correctly founded structure needs to meet the ultimate limit states and the serviceability limit states (the limit states of allowed stress and allowed settlements). The knowledge on broadly defined geotechnics has developed, recently. Changes in design standards for the mentioned foundations were one of its consequences. In the last sixty years, the standards changed few times in Poland. Not only their philosophy was different, but also the calculation procedure. Since 2010, the Eurocode 7 has been currently applicable. In practice, its introduction will certainly take some time and the discussion concerning the former standards will take place. The presented paper is an attempt to take part in that discussion. It is based on the solution adopted for a structure with shallow foundation according to the PN-81/B-03020 standard. The paper presents the comparison between sizes of chosen pad foundations, as well as the strip foundation of the building, designed according to the PN-81/B-03020 standard and calculated according to the PN-59/B-03020 and PN-EN-1997-1 standards. There is no significant difference between the results. It may mean that, in the case of small buildings, the analysed standards give similar results in engineering calculations.

Damian SIWIK, Czesław MIEDZIAŁOWSKI

Deep buildings foundations and their static analysis methods

The paper presents execution methods of deep excavation. Computational methods currently in use, indicating specified by the researchers difficulties and problems in numerical analysis are presented. Directions of further development of the topic of deep foundation static analysis using the finite element method are given. Discussed issues are illustrated by calculation example, in which the influence of the deep building foundation on the displacement-stress state of soil and buildings in direct neighborhood was examined in each stages of implementation.

Paweł SZKLENNIK

Numerical analyses of the direct shearing of non-cohesive soil using the discrete element method

The paper presents results of the numerical simulations of the direct shearing of non-cohesive soil using two-dimensional discrete element method. Identification of contact stiffness parameters as well as sliding and rolling friction coefficients was the main subject of the work. Grain roughness and its shape effect were simulated by increasing friction parameters. Internal friction angles obtained by the numerical calculations were compared with the results of the laboratory tests and the values from the literature sources. It was shown that it is possible to simulate shear strength of soil samples with various grain size distribution using the discrete element method simplified to two dimensions.

Justyna TOPOLAŃSKA, Tomasz Janusz TELESZEWSKI

Heat pump compared to other heat sources in the case of multi-family buildings

The paper presents a characteristics of fuels and heat sources. Special concern was applied to heating with a heat pump. The economic and technical analysis of the use heat pump in multi-family building was performed. The heat pump was compared with another alternatives: heating oil, natural gas and pellets. For each systems of heat sources the total investment and operating costs were calculated. The heat pump had the least operating cost but the high investment cost.

Piotr Krzysztof TUZ, Joanna GWOŹDZIEJ-MAZUR

Analysis of flow in water supply systems in hotel buildings

There is discussion in Poland undertaken about decrease in water consumption in single-family housing facilitates as well as multi-family buildings. The structure of water consumption is well described in these facilities, but on the other hand there are many issues to clear regarding public buildings. The report presents outcomes of research on the water consumption in public buildings (hotels). The study presents detailed structure of water consumption, as well as graphs aimed at max and min level of water flow definition in buildings in question, which directly influences on a proper measuring device selection/choice, on the basis of which water charges are calculate.

Piotr Krzysztof TUZ, Joanna GWOŹDZIEJ-MAZUR

Single yet water meters in B-class (horizontal) after 5 year exploitation in water systems

Water meter in waterwork company is the basic measuring instrument for water consumption measuring, both pumped into the water network as well as at the final recipient. The largest group consists of devices within DN 15 and DN 20 sizes. More and more often, water companies decide to purchase and install water meters of a class C in the water supply network to reduce water losses. Selection of the type of the meter should be subjected to ex. quality of the water in the network. Single-Class B Meters have been the main water measuring device in many companies. The operation time period of water meters in the water network (legalization period) is in Poland five years. The paper presents a study on the metrological characteristics of single dry running meters of a Class B after 5 years of use in water distribution networks, in different water companies