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ABSTRACTS

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Life cycle assessment for achieving sustainable engineering solutions

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The engineering context for sustainability involves the design and management of sustainable technology, research into environmental and social impacts and a good understanding of the limitations of carrying capacity and management of resources using a 'cradle to cradle' life cycle approach to achieve eco-efficiency (i.e. doing more with less).

This presentation covers two key sustainable engineering concepts - life cycle thinking and industrial symbiosis. These tools can potentially assist in the development of circular and green economy principles. Life cycle thinking assists engineering innovation of products and processes (e.g. resource recovery, remanufacturing, multi-functional devices, energy storage system, digitization) during the product/service life cycle to help achieve closed loop material flow and to decouple emissions and resource use from economic growth. Industrial Symbiosis, encourages collaboration between neighbouring industries where waste or by-product of one company become a resource for another company. This symbiotic relationship development (e.g. NOx emitted from a refinery could be a potential resource for an adjacent fertiliser industry) results in the improvement of life cycle performance of products or services by enhancing material efficiency and waste management and offer sustainable engineering solutions.

The Taxonomy for Sustainable Finance

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Following the Paris Agreement of 2015 and the 2030 Agenda for Sustainable Development, the European Commission published in 2018 an Action Plan on financing sustainable growth (COM/2018/097), with the objective of mobilising large private investments towards climate mitigation, adaptation and the Sustainable Development Goals. For this purpose, a Technical Expert Group with 35 highly qualified members was set up in order to provide recommendations to the Commission on, among others, a "green" Taxonomy. This is a classification system of the economic activities that provide, under specific conditions and technical criteria, a substantial contribution either to climate mitigation or adaptation without significantly harming other environmental objectives (Sustainable use and protection of water and marine resources; Transition to a circular economy, waste prevention and recycling; Pollution prevention and control; Protection of healthy ecosystems) and minimum social safeguards.

The proposed Taxonomy was published last June and technical screening criteria for a substantial contribution to climate change mitigation have been developed for 67 economic activities of the following sectors: Agriculture, forestry and fishing; Manufacturing; Electricity, gas, steam and air conditioning supply; Water, sewerage, waste and remediation; Transportation and storage; ICT; Construction and real estate activities. The Taxonomy includes also a proposed approach for an adaptation taxonomy that recognises that adaptation is context- and location-specific and requires the use of a process-based approach to determine if an activity contributes to adaptation and broader system's climate resilience

The presentation will describe the rational, principals, procedure and approaches adopted for identifying the economic activities included in the Taxonomy and the technical criteria to be fulfilled to be consider as "green". Some examples will be also shown.

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Sustainability and circularity in building and construction - good practices

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The presentation aims at demonstrating good practices of smart building and construction and taking the milestones of implementation of Industry 4.0 Roadmap in Hungary. At present, the government, in line with the Irinyi Plan and the new sectoral strategy adopted, supports the automatization and digitalization of the building and construction industry. Innovation-based development of this sector may contribute directly to a higher efficiency and an improved performance. Furthermore, cost-and resource-efficiency are high priorities of the sustainable development strategy of this industry. Based on latest statistics, building and construction industry is responsible, along a quadruple-helix, for 6% of the current GDP in Hungary and performed a significant growth during the last two years. (In comparision, at an avergage, it is about 9% in the EU.) Among the issues and limitations of the strategy implementation we should list the number of micro-enterprises, the status of the regulation and control, the volume of the local materials and capacities as key factors and conditions. Innovative initiatives as the creation of the Center for Industrial Cooperation in Higher Education (FIEK), the infrastructure set up in the GINOP-1.1.3-16 Industry 4.0 Model Cities project, the national Model House Park in Szentendre or the Tech Development Program ÉPÍTŐ are steps forward a more sustainable sector and a built environment itself.

Better Access of SMEs to Key Enabling Technology services and micro-grants for Clean production

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KET4CleanProduction is a Horizon 2020 CSA project (https://www.ket4sme.eu/about-ket4cp) with the participation of twenty partners from 18 European countries. Bay Zoltán Nonprofit Ltd. (BZN) is Hungary's leading applied research institution is assuming important role in disseminating Clean Production solutions in the Central European region. BZN provides R&D services to companies in Hungary and strives to enhance the competitiveness of SMEs through innovation and technology transfer.

The main target of the project is to foster the use of advanced manufacturing technologies and related key enabling technologies (KET) by Small and Medium Enterprises (SME) to upgrade their production processes toward resources – energy efficiency and sustainability.

The ket4sme.eu platform offers a specialized and active support in the field of advanced manufacturing and key enabling technologies matching SMEs with research technology organization active in the field of KET service/providers;

A dedicated community is established, in the framework of the project KET4CleanProduction, which aims to backup an open innovation ecosystem to develop innovative solutions for cleaner production processes throughout Europe, and operates a 2 million € Microgrant funding for SME-s to get support in making the step towards clean production. The microgrant call will be described in details.

The community focuses on the following main stakeholder groups:

Manufacturing Small and Medium-sized Enterprises (SMEs)

KET Technology Centers (KET TCs)

Enterprise Europe Network (EEN) partners and Business support organizations (BSO) (as supports EEN’s mission to generate partnership profiles, advisory services outcomes, transnational partnership agreements)

Bay Zoltán Nonprofit Ltd. (BZN) is Hungary's leading applied research institution. BZN provides R&D services to companies in Hungary and strives to enhance the competitiveness of SMEs through innovation and technology transfer. Bay Zoltán Nonprofit Ltd. plays an active part in the Hungarian and regional innovation systems and works with international partnersthrough industry projects. The research divisions offer complex scientific and technical solutions to SMEs and large enterprises in Hungary and internationally

Analytical and Numerical Study for Minimum Weight Sandwich Structures

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Manufacturing a light-weight structure with affordable cost without sacrificing strength has been a challenging mission for designers. The global companies of manufacturing and development are competing to design lightweight containers to satisfy the requirements of shipping and airlines carriers. The honeycomb sandwich structures are widely applied in the field of industry of shipping and air cargo container. The companies of development and manufacturing seek to produce lightweight structures which can be used for manufacturing of the walls, floor and the roof of the containers which, consist of Aluminium honeycomb core and composite material face-sheets (carbon or glass fibre). This applications require the complete understanding of the mechanical behaviour of structure. The static and the dynamic experiments are required to achieve the mechanical properties of the structure such as 4-point bending and forced vibration tests. The bending test is required to obtain the static characteristics of the structure such as deflection and stress. The honeycomb of the sandwich panels must be designed to withstand the vibration environment, whether from the impact of ocean waves on ships or air bumps in the sky on airplanes. The vibration test is required to obtain the dynamic characteristics of the structure such as natural frequencies, stress and acceleration responses. The goal of this test is to predict the vibration response of honeycomb sandwich panels due to the dynamic loads. Numerical results were calculated by using FEA (Digimat program). In this paper, a methodology for a minimum weight optimization for sandwich panels is presented. The weight of the sandwich panels considered is the objective function subject to required constraints based on the stiffness, face-sheets failure, skin wrinkling and core shear. Matlab software was developed to obtain theoretical results and compare them with numerical and experimental results. The strategies of composite sandwich structures depended on Classical Lamination Theory and calculate the ply failures by using Tsai–Hill failure criterion. The lightweight containers provide a huge savings in weight and thus reduce fuel consumption or increase aircraft turnover compared to conventional containers. According to the International Air Transport Association (IATA) calculations, the weight of fuel required to carry 1kg additional weight per hour is 0.04 kg.

Comparison of the mathematical modellisation and physical simulation of strain induced crack opening

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Cracks appear when deformation caused by restraint and thermal shrinkage together cannot be accommodated by plastic deformation. During welding to such alloys this also happens, which segregate on heating and cooling at near-solidus temperatures, in particular when low-melting and mechanically weak phases form and occur over a wide range of temperatures. To check for susceptibility to the liquation cracking caused by the low-melting, weak phases, hot tensile testing can be used in combination with a thermal cycle resembling that of real welding. This procedure, which can be executed on a GleebleTM Thermal-Mechanical Simulator, comprises tensile testing of a number of cylindrical samples at the temperatures below solidus and determining their hot strength and ductility. An alternative to the hot tensile test during the simulated welding cycle is the Strain-Induced Crack Opening (SICO) test, in which a rod-like sample mounted in “cold” copper jaws of the Gleeble is heated by electric current and then compressed till formation of a bulge in its uniformly heated central portion and appearance of cracks due to secondary tensile strain developed along the maximum perimeter of this bulge. Next to the studies of liquation cracking and ductility-dip cracking of the reheat-type, the Gleeble procedures can be also used to determine sensitivity to solidification cracking and for this the samples are melted and solidified in a controlled manner before the hot tensile testing or the SICO testing. The developed routines of the Gleeble testing allow accurate determination of temperatures at which the cracks occur as well as measurement of critical strains to fracture and strain rates which are associated with the hot cracking. At an appropriate geometry of samples and optimum setting of the experiments, the hot cracks generated in the samples have sizes comparable to those that occur in heat-affected zones of real welds or in weld metals.

We performed experimental series for SICO test of the ZF 50 material grade. Identical specimens were used for the experiments under the same conditions. After the experiments microstructural analysis and hardness test was made on the compressed areas. Also mathematical modellisation was made with same geometry. And the result of the physical simulation and the mathematical modelization were compared.

A comparison between hybrid method technique and transfer matrix method for design optimization of vehicle muffler

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Exhaust and muffler noise are a challenging problem in the transport industry. While the main purpose of the system is to reduce the intensity of the acoustic pulses originating from the engine exhaust valves, the back pressure induced by these systems must be kept to a minimum to guarantee maximum performance of the engine. Modern mufflers typically have a complex system of chambers and flow paths. There are a variety of sound dampening mechanisms working to quiet the sound flowing through a muffler and piping system. This study presents an efficient process to optimize the transmission loss of Audi A6 C6 2.0 TDi reactive muffler by using both experimental and analytical methods. Two calculation method were selected for this study. The muffler has a complex partition which is perforate plate located in middle of muffler chamber. CAD file of the muffler was established for developing FEA model in ANSYS by another commercial advanced design software (CATIA V5). FEA model was validated by experimental measurements using a two-source method. After the model was verified, sensitivity studies of design parameters were performed to optimize the transmission loss (TL) of the muffler. The experimental and software analysis results are included in the paper. Recommendations are made for obtaining smoother transmission loss curves for various measurement methods.

Estimation of compressive strength of current concrete materials: effect of core diameter and maximum aggregate size

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Deterioration of reinforced concrete (RC) structures is one of the major issues facing the building's service life. The estimation of the compressive strength of concrete, among others, is an important input to evaluate the safety of existing RC structures. Most standards, which address the assessment of the compressive strength of existing RC structures, recommend testing cores drilled from these latter. The diameters of these cores are usually smaller than the recommended diameter (i.e., 100 mm). It is worth noting that the core diameter and the maximum aggregate size are some of the parameters that should be taken into account in the interpretation of the compressive strength results. A good understanding of the influence of these parameters leads to a better estimation of the concrete compressive strength of existing RC structures.

In this paper, a total number of 241 cores of current concrete material (C25/30 and C30/37 strength class) were tested. The effects of core diameter (Ø=100 mm, 75 mm, 50 mm) for double length-to-diameter (L/D) ratio and maximum aggregate size (Dmax=25 mm, 16 mm, 8 mm, 4 mm) on the compressive strength of cores have been studied. Test results showed that maximum aggregate size significantly affects the compressive strength of cores. As the maximum aggregate size increase the compressive strength of cores decrease. This result was more pronounced for the 50 mm core diameter. However the smallest core diameter Ø=50 mm with maximum aggregate size Dmax=25 mm, presents the highest scatter. As far as the effect of core diameter on the compressive strength is concerned, tests results showed a slight sensitivity. In this case, correction factors of core compressive strength have been proposed. A correlation formula between compressive strength of 100 mm core diameter and the characteristic compressive strength of standard specimen 150x300 mm^2 is also pointed out.

The Effect of The Gear Wear for The Contact Ratio

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The contact ratio is such a parameter of a gear, that is very important because of the noise of the drive and the quality of the mesh. In general condition the contact ratio can be considered constant during the whole lifetime. Although there are applications where the gears are working without any lubrication, and the only criteria of the lifetime. Among these conditions the measure of the wear can be so extensive, that has a significant influence on the contact ratio in a quite long period of the lifetime. In these cases, the contact ratio decreases, which leads to the increase of the dynamic loads. The pressure line can be move, which results the modification of the tooth bending force's arm. It is easy to understand that this phenomenon depends on geometrical parameters, the initial conditions, relative movements and the loads. This means, not only the measure of the wear can be restricted by the strength, but the new geometry. In these conditions the operational characteristics can be significantly different from the original, which was determined by calculation. Because of that, it is expedient to suppose more conditions as a basis in case of non-lubricated gear drives. It is recommended to calculate in every condition the safety factors. If we know the measure of the wear, we can determine when will be the gear pair inoperable with the use of known calculations. This paper shows an iterative process, in which the suspected measure of the wear is used as tolerance, the possible consequences were determined.

Determination of GTN parameters using artificial neural network for ductile failure

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The Gurson–Tvergaard–Needleman (GTN) model, is widely used to predict the failure of materials based on lab specimens, The direct identification of the GTN parameters is not easy and its time and money consuming.

The most used method to determine the GTN parameters is the combination between the experimental and Finite Element Modeling results and we have to repeat the simulations for many times until the simulation data fits the experimental data in the specimen level (axisymmetric tensile bar and CT specimens).

In this paper, we determine the GTN parameters for the SENT specimen based on the fracture toughness test of CT specimen.

The reason for choosing the SENT specimen is because it can be a very good representative of the pipe.

In this work, we are going to present how the artificial neural network (ANN) method could help us to determine the Gurson parameters in a short time and with good accuracy.

The results obtained from this work show that the ANN is a great tool to determine the GTN parameters in addition to this the determined parameters respect very well the literature, moreover, the Gurson model predict very well the crack initiation and crack propagation for the SENT specimen.

Investigating three learning algorithms of a neural networks during inverse Kinematics of robots

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Deep learning for inverse Kinematic problem of robot manipulators was investigated by many works considering the planar case. In this paper, the performance of the three learning algorithms; Levenberg-Marquardt algorithm, Bayesian regularization algorithm, and scaled conjugate gradient algorithm is studied will learning single hidden layer network how to solve the inverse Kinematic problem of a three degree of freedom robot manipulator.

Prediction of distillation plates' efficiency

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This study deals with the prediction of different types of trays' efficiency in rectification columns, in case of low carbon content hydrocarbons (for example ethane-ethylene and propane-propylene) separation. During these technologies typically trayed columns are used, therefore the bubble cap and sieve trays were examined in this paper.

In the previous studies we have assumed that the leaving vapour and liquid from each tray is in equilibrium. It assumed that the trays have 100 % efficiency, however in practice this supposition is not true. It means that it is necessary to determine the actual efficiency of the trays, because this value gives the actual trays' number too. The examined methods are the O'Connell method and the AIChE method.

This study's goal is to calculate and compare different trays' efficiency, because it has an effect of the tower height.

In petrochemical industry the previously mentioned hydrocarbons have a high importance, these are the raw material of the plastic manufacturing. Generally, hydrocarbons are produced by distillation from higher carbon content materials, and this procedure has extremely high energy consumption. With higher plate efficiencies the costs can be reduced.

Optimization of an integrated renewable electricity storage system

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The irregularity of electricity production from renewable energies as well as the electricity consumption which does not frequently correspond to the production cycles of these inevitably lead to the preservation of buffer storage.

Storing energy is a real technical and economic challenge because renewable energies are, by nature, diffuse, intermittent and difficult to predict. It is therefore necessary to store this energy surplus and, in the absence of production, to restore it as needed. Energy storage contributes as much to securing a consumption site as to feeding an isolated place.

The purpose of this paper is to study energy management algorithms. These algorithms will aim to allow optimal matching between source availability and energy consumption, while ensuring power supply security for strategic sites. These algorithms will be based on forecasts, constantly updated, local production and can act on the storage of energy and consumer functions, in compliance with the constraints of each application.

In a first phase, an analysis of the energy consumption of the load and its control-command will be carried out. This analysis should allow to get into the problem but will also lead to the proposal of an abstract model of each specific consumer applications. On the other hand, energy efficiency criteria taking into account the management of the different sources will be defined. In a final phase, these different models will be integrated and optimization and control algorithms will be proposed to maximize the energy efficiency of the system. The proposed algorithms will be tested and validated using the Matlab / Simulink tool.

This research work will focus on the storage of electricity by the in situ production of the reserve (hydrogen-electrochemical ...), with a particular interest in small-scale systems (a few kW). The advantage of these reduced systems is that they can replace centralized reservoirs with decentralized systems, and can eventually be installed in individuals living in remote locations far from the grid.

There are several storage technologies around the world, some of which are under development. One of the most promising technologies is the storage of renewable electric energy through the production

of hydrogen and solar battery charging. This requires integrating means of production, especially from renewable energies, and consuming locally the energy produced.

The system will consist of a photovoltaic field, a fuel cell as generators and auxiliaries represented by the electrolyser, the batteries, the power interfaces and the control-command and efficiency devices energy.

The contribution of heuristic methods and artificial intelligence for the optimization of such systems that differ not only by the hybridization of different technologies, but also by the nature of their products (electricity and heat) is an absolute requirement . The goal is to ensure safe supply conditions consistent with the use of strategic sites.

For all the proposals, particular attention will be paid to the development and adjustment phases of the algorithms and models in order to guarantee an optimal level of efficiency for strategic applications

CAD Tools for Knowledge Based Part Design and Assembly Versioning

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Increasing the efficiency of production processes is crucial in modern manufacturing industry. Automating and supporting processes with modern IT tools plays an important role in this effort. Applying new software, models and algorithms, the design / production time and cost can be significantly reduced. There are several potential development areas, but two are mainly focused nowadays: the specification of the different physical characteristics of the products and to introduce automated methods for creating CAD models and its assemblies from already existing, similar product designs.

This paper presents software tools to enhance productivity of common part design tasks. They are developed for the widely used Siemens NX CAD system. The first module is an interactive multi component software tool, which was developed for supporting similarity-based product design. This application can use online product repository, makes possible to search by any specific parameters and export a new parameter file for creating new parts. The second module offers an UI driven automatic way to enhance component replacement process of a complex assembly. The presented modules make the whole development process more effective, because they are suitable to semi-automate the 3D model creation process. Applying these, human errors can be reduced, and the modelling process can be significantly accelerated.

Heat transfer analysis for finned tube heat exchangers

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This present paper fulfills a parametric study about heat exchangers with extended surface. These finned tube heat exchangers commonly used in industry, household and automotive industry. With the use of different type of fins a much higher heat transfer area can be achieved. However, while this extra surface advantageous for the heat transfer area, disadvantageous to the heat transfer coefficient. This current research focuses on the effect of the size of the transversal fins to the heat performance of the finned tube. Numerical computational fluid dynamics-simulations have made to investigate the air side flow and heat transfer characteristics. Using the result data and previously published experimental data, new correlation for estimation of heat transfer coefficient have been established.

Effect of Soil Reinforcement with Stone Columns on the Behavior of a Monopile Foundation Subjected to Lateral Cyclic Loads

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Monopile foundations are usually used to support structures, such as, electrical tower, foundations for low-rise building on weak soil and wind tower foundations. These structures are usually subjected to lateral cyclic loads generated by earthquakes, winds and waves. In order to support these loads, the design engineer usually chooses either to increase the pile diameter, pile length or both. However, these solutions increase the price of the project. Another solution, which is more economic, can be adopted. This second alternative consists of reinforcing the adjacent soil of the pile with stone columns. In order to evaluate the effect of stone columns on the behavior of a monopile under lateral cyclic loads, we performed a numerical Plane Strain model using the finite element software PLAXIS 3D in conjunction with the constitutive model "Hardening Soil model with small strain stiffness (HSS)". The constitutive model was first calibrated and validated using measured data from centrifuge tests on a monopile in Fontainebleau sand. In the second part, a series of analyses were then carried out where cyclic lateral loads were applied to the pile for investigating the length and the diameter of stone columns.

Performance of Cold Formed Steel Shear Wall Panel with OSB Sheathing under lateral load

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Cold-formed steel shear wall panel is one of a lateral load resisting system in seismic and/or wind area. A typical shear wall panel "SWP" is composed of cold-formed steel "CFS" framing members and sheathing boards. Due to the diversity of architectural dimensions, the numerical approach, using finite element "FE" models, has become a good alternative to predict the global behavior and assess the shear strength of the SWP for various geometric characteristics instead experimental tests. In this paper a detailed modeling technique of a Shear Wall Panel "SWP" with OSB sheathing is presented by using finite element, in order to evaluate these performances under lateral load. Material and assembly nonlinearities are introduced in the FE model. The orthotropic material of the OSB sheathing is also considered. The results obtained by the finite element model have been validated with corresponding experimental data. A good arrangement in the nonlinear response has been achieved. Moreover, the performance in terms of shear strength and ultimate displacement has been assess, conforming that the proposed finite element model can be used to predict the nonlinear behavior and the shear strength of cold formed steel shear wall panels with OSB sheathing.

The use of the linear sliding wear theory for open gear drives that works without lubrication

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In this paper the author tries to introduce calculation formulas of the linear sliding wear theory. It also deals with the pitfalls and difficulties that are present while the use of the formulas. In the last two years calculation of the wear appeared in more research and development projects of the Institute of Machine and Product Design at the University of Miskolc. This paper shows the experiences about the calculation of the wear. In the publication the estimation of the wear will be presented by an example. The example is a gear drive of a starter motor, that is used to start a combustion engine. This drive is an open gear drive and it has no lubrication. The pinon has a great extent of wear, which is not acceptable in an average gear drive, but in these conditions is adoptable. The reason of this, that the gear drive of the starter motor is capable to do its task: starting the combustion engine. I used microscopic pictures to determine the size of the wear and the new form of the teeth. The hardness of the tooth surface was measured as well, to exclude that the reason of the wear was the insufficient hardness or not. The publication shows more phenomenon, that occur during and after the contact process of the wheels. This kind of phenomena is the change of the common face width, or the friction of the faces of the gear wheels.

Numerical simulation methods of stress corrosion cracking

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Stress corrosion cracking (SCC) can appear in numerous components used in the different industries for example in the airline-, oil and gas-, nuclear industry. SCC is a localized failure method which is more severe under the combined action of stress and corrosion than would be expected from the sum of the individual effects acting alone. Three indispensable factors – environment, material condition, mechanical loading – has to be present for the SCC to occur. Numerical modelling has become a widely used analysis technique in the engineering world, therefore also in case of the stress corrosion cracking numerous models have been made, and are still being developed. These models are based on different kind of mechanism. The most important ones are the Slip Formation/dissolution mechanism, hydrogen assisted SCC and the mechanism based on oxidation. SCC has two types, the transgranular (TSCC) and inergranular stress corrosion cracking (ISCC). In the article the different kind of numerical methods are going to be introduced in case of intergranular stress corrosion cracking.

Implementation of a customized CAD extension to improve the calculation of center of gravity

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This paper presents an automated system that can effectively support human work, thereby speeding up the Computer Aided Designing process. The motivation of the research and development task was to implement a module in an existing CAD system which can calculate the center of gravity which requires investigating the distribution of the mass. There were complex CAD models designed in the application called Siemens NX. It has some built-in functions for designers for supporting the calculations. The first chapter of the paper overviews the mathematical background of the calculation. For software development point of view the authors investigated the programming facilities of Siemens NX. Investigations showed that the first task is to assign material properties for the components that are in the design. Our goal was to automate this task as the manual material attribute assignment is time consuming and potentially leads to errors.

For performing this task, the relevant documentation and literature has been reviewed. A recently published model carries out material assignment by identifying the relationship between shape, functionality, and material in parts. There is a study that analyses the basic concepts and relationships affecting all aspects of material selection.

In this paper a new software component is presented providing an approach for material assignment. The center of gravity calculation based on the valid material data then provides a reliable result. The Siemens NX software plugin developed by the authors has been installed and actively used by our industrial partner.

Towards CHP system: Preliminary investigation and integration of an ORC cycle on a simple gas boiler

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In order to meet both the increasing demand of electricity and the drastic reduction of fossil oil, the Algerian government has implemented the national energy efficiency program. This program focuses mainly on improving the use of renewable energies, for the purpose of producing 22 GW of electricity by 2030. The program promotes also the energy efficiency in both residential and industrial sectors. In this context, the Organic Rankine Cycle (ORC) seems to be a suitable solution either for exploring renewable resources or to be integrated in industrial process to produce electricity from waste heat recovery. Thus, a possible integration of an ORC system within a simple boiler of the national polytechnic school is investigated. Such solutions allow converting the gas boiler into a Combined Heating and Power (CHP) system. Thus, the new system with a higher energy performance will produce simultaneously both heating and electricity. A thermodynamic analysis of a sub critical ORC cycle using the Cool Prop free tool is presented. The presented work is a case study applied to the gas boiler installed within the national polytechnic school of Constantine. The proposed ORC cycle is activated by the boiler's exhaust gas of about 400 °C to produce mechanical work while condensing the working fluid is performed by geothermal probes.

Examination the effect of environmental factors on a photovoltaic solar panel

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In this study, the energy generation of a solar panel in case of different surface contaminants is experimentally examined. The energy production of a solar cell is significantly influenced by the contamination of the panel's surface. Not only the objects in the environment, but pollutants on the panel's surface can also create a shadowing effect. The energy production and the efficiency of a solar panel are experimentally investigated in case of different types of contamination, such as leaves, dust and simulated bird excrements. Measurements are done with different polluted areas and the amount of pollution. A correlation between the power generation and the contamination is observed. Following the observation, it is possible to determine the loss of energy production, caused by the surface contaminants, while the optimal cleaning period can be determined. Environmental factors directly affect the output voltage. Power production and type of contamination show a certain correlation. It is possible to determine the voltage and power production drop depending on the surface contaminants.

Thermal behaviour of PCM-gypsum panels using the experimental and the theoretical thermal properties-Numerical simulation

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The determination of thermophysical properties of PCM remains a very important step in the process of thermal management by assessment of energy saving performance of PCM composites and for evaluation of the energy saving performance. In this paper, experimental measurement and theoretical determination of thermal conductivity, specific heat capacity and density were carried out and compared for different panel compositions with 10%, 20%, 30%, 40% and 50% of microencapsulated PCM mixed with gypsum and for several thicknesses of panels (10 mm, 30 mm, 50 mm, 70 mm and 90 mm). These measured and theoretical values were used to make numerical simulations by two methods. The first method is numerical simulation of heat transfer by conduction in the panels by using experimental values of thermophysical proprieties and the second method is numerical simulation of heat transfer by conduction in the panels by using theoretical values of thermophysical proprieties. The results of these numerical simulations revealed that the maximum difference on the temperature swing between the two methods can reach 0.8 °C for 50% of PCM in gypsum. Besides, the results showed that the maximum daily phase shift does not exceed 0.7 h between the two simulation methods.

Experimental and numerical study of the thermal behavior of a building in Algeria

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This work presents an experimental and numerical study of the thermal behavior of the High-Energy Performance Housing (HEPH) made within the framework of the national energy management program (PNME) of the 600 dwellings of the collective rental type (LPL) compared to a control housing.

To study the influence of the energy efficiency measures which have been introduced on the HEPH project, a measuring equipment has been installed to quantify the energy saving in gas and electricity as well as to measure the thermal comfort parameters which are mainly defined by temperature and humidity.

A dynamic thermal simulation work was carried out with the thermal simulation software TRNSYS 17, to study the effect of thermal insulation on the improvement of the energy performance of the two dwellings.

The results showed that the insulation had effectively contributed to improving the thermal comfort in winter period as in summer period. It has also been shown that HEPH saves 42% on heating and cooling energy compared to a control housing.

Comparison of Sakiadis and Blasius Flows Using Computational Fluid Dynamic

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The aim of this work is to apply CFD simulation on air flow over flat plate to study the problem of hydrodynamic and thermal boundary layer and to analyse the effect of the length of the plate. The simulation ANSYS Fluent R18.1 has been applied to solve the governing equations of the flow. The simulation results have been verified by comparing the numerical solution with the analytical solution. The effect of changing the length of the plate is investigated while the other quantities were considered constant such as the free stream velocity, density, viscosity and temperature. The result showed excellent agreement between the numerical solution and analytical solution with maximum error 6.19%. It is obtained that the Reynolds number increase as the plate length increase. However, the maximum value of the velocity contour, the Nusselt number, the wall shear stress and the skin friction coefficient decreased.

Techniques for evaluation of mixing efficiency in an anaerobic digester

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Mixing plays a pertinent role to ameliorate anaerobic digestion process efficiency. This study analysis the miscellaneous effects of mixing at various mixing intensities on different stages of digestion process. Various mixing speeds (10, 30, 50 and 100 rpm) were analyzed and biogas production rates were noted. Dog food was used as substrate for anaerobic digestion. Three Rushton turbines was used for mixing in 9 l lab-scale digester. Intermittent mixing seems preferable in terms of quality and quantity of biogas along with lower power consumption. Optimization of mixing in terms of mixing speed and mixing time was focused especially at different stages of digestion process (hydrolysis, acidogenesis, acetogenesis and methanogenesis). Optimization of digester and impeller geometry should be prime focus to scaleup lab-scale digesters and optimize mixing in full-scale digesters.

Vehicle routing in drone-based package delivery services

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The Industry 4.0 enables the operation of new logistics equipment and new logistic solutions based on cyber-physical systems. The usage of new transport devices is discussed in this article in case of the Vehicle Routing Problem. In basic Vehicle Routing Problems the demands of customers must be served. This article discusses a new Vehicle Routing Problem where drones are also used to improve the flexibility, reliability and cost efficiency of the whole last-mile solution. During the problem, a drone is assigned to the truck performing package delivery services, and some customers are visited by the truck while the drone is sent to certain customers located in the near environtment of the truck. The drone has a capacity limit, so it is able to visit only a limited number of customers. After visiting the customers, the drone recovers the goods from the truck and serves the demands of new customers. In this article the above mentioned problem is solved with construction and improvement algorithms. The construction algorithms are the Nearest Neighbour Algorithm and Arbitrary Insertion Algorithm, the improvement algorithms are the Genetic Algorithm and the Hill Climbing Algorithm.

Cyber-physical waste collection system: a logistics approach

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The increased population has a great impact on the volume of household waste. The conventional waste management systems can be divided into two main parts. The first part is represented by recycling technologies, including incineration, processing, reuse and shredding. The second part includes the processing related logistics and material handling operations. The collection of household waste is performed in a wide geographical area which means that collection represents a significant part of the whole costs. Waste management systems need up-to-date technical, technological and logistics solutions to increase the efficiency, the reliability and the flexibility. The application of Industry 4.0 technologies offers a good opportunity to transfer conventional waste collection and processing systems into a cyber-physical system. Within the frame of this paper, the authors show the concept of smart waste collection as a cyber-physical system. After a systematic literature review, this paper introduces the concept of smart waste collection including smart bins based on RFID technology in order to support waste volume prediction, cloud and fog computation based decision making in order to optimize the allocation and utilization of technological and logistics resources.

Efficiency improvement of reverse logistics in Industry 4.0 environment

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Nowadays, the increase in consumption and the shortening of the life cycle of products significantly increase the amount of waste generated, causing serious environmental problems. As a result, waste management has become one of the most important tasks of the 21st century, which puts a huge burden on the economy.

Waste management means the practical implementation of the protection of the environment from the harmful effects of waste on the entire life cycle of the waste. This is a process that involves the prevention, reduction, separate collection and utilization of waste generated, the temporary storage and disposal of non-recoverable waste without pollution. It follows from the above that logistics functions and services are playing an increasingly important role in waste management, which has contributed to the development of reverse logistics. The task of reverse logistics is, among other things, to collect, store and dispose of waste generated inside the company.

In this thesis, we have set out to develop a concept for the optimal design and operation of a reverse logistics system for a production company. Nowadays, in order to meet the dynamically changing customer needs, the development of Industry 4.0 capabilities of manufacturing companies is essential to increase their efficiency and expand their capacity. To achieve this goal, digitization and vertical and horizontal integration need to be strengthened. In this study, we will demonstrate, through the example of a sample factory with Industry 4.0 technology, how to use the simulation to determine the optimal design of a reverse logistics system.

Application of sigmoid curves in environmental protection

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Sigmoid curves can describe a lot of phenomena in the world: iteration history of optimization algorithms, time history of sports world records, competition of populations, product lifetime, etc. Approximation of a sigmoid curve can give many interesting and useful information about the most important characteristics of the growth speed, expectable maximum of the phenomenon, maximum possible value achievable, steepness of the curve. The investigation of the derivative and the integral of the sigmoid curve can give more information about where is the maximum of the growth speed, and how durable of the maximum speed is. These results could increase our knowledge when investigating a phenomenon (growth history, stauration, future behaviour of the phenomenon). In this paper the qulity of plastic contamination of the world oceans is investigated. The history curve of the world's plastic production is a sigmoid curve (logistic curve), so every useful information which can derived from the curve, from its derivative and integral can be applied to the present and to the future of the contamination quantity, because there is a strong connection between the quantity of produced plastics and of the plastic contamination quantity of the seas. The results of the investigation of the sigmoid curve of the plastic contamination will give us information about the history and about of the future of the contamination process. Better understanding of these characteristics of the phenomena could help to design better the future steps to stop or at least decrease this dangerous contamination form. During the approximation of the sigmoid curves, the Nelder – Mead optimization technique is applied for the solution of the least squares approximation problem.

Comparative study of the influence of traditional walls with different typologies and constructive techniques on the energy performance of the traditional dwellings of the Casbah of Algiers

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Traditional building is a living complex that reflects the needs for which it was built. The house always responds to the way of life of its inhabitants and is characterized by the centrality, the introversion of the built space and the arrangement of rooms around the patio.

The traditional houses are built on the basis of local, natural and ecological materials, responding to a good energetic efficiency in terms of inertia and thermal resistances. These traditional processes could be a basis of reflection for the design of sustainable architecture, and which would connect the man and his natural environment. (Ghaffour, 2014)

The Kasbah of Algiers is part of this heritage. Classified safeguarded sector by the national commission in 2005 and world inheritage in 1992. Its traditional dwellings are distinguished by their very interesting constructive typologies and specific equipments of mixed walls (Opus spicatum and opus incertum) as well as by other compositions with local materials (brick, rubble, wood ...) giving a wall thickness between 40 to 70 cm (Abdessemed, 2005). They are mainly distinguished by the principles of ecodesign, environmental symbiosis and climatic adaptability.

The present work aims knowing the influence of a traditional wall on the energetic performances of a dwelling of the kasbah of Algiers through different compositions, as "Brick - Wood" and "rubble superimposed with bricks" in order to choose the most suitable typology for the ecological and environmental question, as well as the concept of compactness which solves the problems of thermal losses and which makes it possible both to reduce the energy consumptions and to increase the comfort (Munaretto, 2014).

The adopted methodology is structured on the characterization of materials and an evaluation, through a series of simulations, of the influence of thermal inertia on the energy performances of different types of traditional walls while consolidating the results of this evaluation through a comparison to a referential normative framework.

The results obtained allowed us to enrich the ecological framework of the materials by determining the optimal composition to the ecodesign for a better revaluation of our built inheritance and a better safeguarding of environmental resources.

Rules of environmentally friendly packaging

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The paper deals with the environmentally friendly packaging. As the environment consists of not only the environment itself, but the human and the product are also part of it, the interrelation of the product-human-environment cycle should be analysed. It should be scanned what the designer should keep in front of the eye during the design process of an environmentally friendly package. Of course, on behalf of protecting the environment one of the most significant questions is the material that is used for the package. It should be kept in one's mind what kind of effects have the packaged product on the package and how does this effect work backwards. If we look on the package as it is the product we should analyse the effect of the package on our green environment and on the users as well. For example, is the material of the package degrades, is it easy to open the package? What will and what can the user do with the packaging material when he or she does not need it anymore? The paper deals with these questions of designing an environmentally friendly packaging.

Aluminium infinite green circular economy – theoretical carbon free infinite loop, combination of material and energy cycles

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Aluminium is the 3rd most abundant element of the Earth's crust. Novel technologies which appeared recently decreasing the carbon consumption of the aluminium life cycle. Aluminium both is a widely used structural material and an energy carrier. Thus, an infi-nite double life cycle can be drawn which demonstrate that the economy circle of alumin-ium as a permanent material or as an energy carrier can be combined into one infinite loop. Several recent innovations played a role in closing the loop as novel structural mate-rials like hybrid aluminium and novel energy conversion devices as aluminium batteries. The material circle: aluminium production, fabrication, manufacturing and waste handling is made green by the invention of novel technology of carbon free melting of the scrap. The energy cycle: energy aluminium production, assembly, discharging, charging is made green by the novel carbon free smelting process closing the two cycles into one infinite green loop. In this sense aluminium is the sole solution for the humankind to be the basic metal of our everyday life in the future.

Is packaging going circular or in circles?

-Ecodesign for Sustainable Packaging-

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In recent years, challenged by the European Union Directives, interest in the concept of the "circular economy"- has increased drastically. This is specifically true for the packaging industry. In contrast to a conventional linear (make-use-dispose) economic model, a transition to a circular economy should result in significant environmental benefits including greatly improved resource efficiency. Even though the concept of Circular Economy is more than "recycling" as much as possible, industry is focusing on this aspect of their product's life cycle. With the amount of investment in making products more circular, it is legitimate to ask if more circular products are also necessarily more environmentally beneficial, including aspects such as climate change or acidification.

Methodology

In 2015, the Ellen MacArthur Foundation (EMF) and Granta Design published a methodology for assessing the circularity of a product or an organization and reporting this as a Material Circularity Indicator (MCI). Life Cycle Assessment (LCA) studies have very similar data requirements to the MCI in terms of reporting on the quantities of material and waste flows over a product's life cycle. Moreover, software tools have been available for many years to support LCA modelling and make it easier for such models to be developed and adjusted. Thinkstep has now developed an ecodesign tool that can calculate a product's MCI based on the formulas provided by the EMF, reported either as a stand-alone value or as a complementary metric to LCA results in the GaBi Software.

Results

By combining the power, flexibility and utility of LCA software with the MCI methodology users can calculate the circularity of products even for complex production processes and compare them with LCIA results (Climate change, Acidification etc.). Based on examples we will demonstrate trade-offs between the larger scope of environmental friendliness and circularity. The results are reported clearly, and users are enabled to adjust model parameters to investigate how different design choices will influence environmental impact and circularity of their products. This enables us to do an enhanced analysis of new products and technologies and identify the most meaningful direction for new developments.

Life Cycle approach of a new Industrial Symbiosis alternative

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In frame of CIRCE2020 the participants searching new technologies in field of waste treatment, in order to close the loop of material flows in case of different companies. During this project had searching these possibilities on the industrial areas of Central Europe. As partners form Hungary, the IFKA and Bay Zoltán Nonprofit Ltd. are working on this project. This study contains MFA, LCA and LCC result from the possible waste streams. The MFA outcomes will be important part the further life cycle analysis. During the analysis had to compare the currently and one (or more) possible (developed) way of waste handling. This research can help achieve the concept of industrial symbiosis and circular economy on the pilot areas. This study contain the fulfilled life cycle assessments for the Hungarian pilots. Two waste stream had chosen for assessment. First is the byproduct of tyre production and the other waste remains of the ostomy (as multicomponent plastic waste) production. In case of the waste streams had analysed the currently waste handling life cycle results, against a modern, sustainable way result. The data what had been applied for the assessment originate from companies what are operate on the pilot industrial areas. This research will continue until 30/06/2020 in frame of CIRCE2020 project.

Possibilities for adopting the circular economy principles in the EU steel industry

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The European Commission adopted the Circular Economy Action Plan in 2015, that is key in modernizing industry and gaining global competitive advantage of the European Union (EC 2015, 2019). Today's economic policies aiming at environmental and energy efficiency mean a major challenge for those energy-intensive sectors that operate with traditional technologies, such as the steel, paper and cement industries. These branches account for nearly 40% of total industrial sector energy consumption. Due to the high level of vulnerability of the energy-intensive sectors to energy price volatility, the adverse events affect their resource management, especially their cost structure. (Kádárné Horváth 2014; Odyssee-Mure, 2015; EC 2019).

The circular economy offers an endogenous solution to these problems of the energy-intensive sectors. By using the best industrial practices serving the realization of circular economy, such as utilizing waste as energy, cost reduction can be achieved and the cost structure of companies can change beneficially. The introduction of the circular economy as a business model will also reduce environmental damage by modernising waste management, integrating renewable energy sources and avoiding fossil fuels. (EC 2019)

In our article, based on the available studies and statistical data, we examine how energy-intensive manufacturing companies can engage in the concept of the circular economy and how they can successfully apply this new business model.

Influence of urban morphology on the environmental impacts of district. Applied LCA

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Rethinking the city and its entities in such a way as to place them in a purely ecological framework raises major concerns that appear to be as pressing as they are burning today in the face of an environmental ataxia caused by an urban macrocephaly, generated at different scales, thus leading to innumerable environmental impacts whose causal factors appear upstream of development projects whereas the response effects degraded different compartments of the environment.

The district that appears among these scales, between the city scale, characterized by an inhibiting complexity, and the building scale, which is rather limited and punctual, is presented as a relevant base to identify in an operational way, the influential factors and the generated impacts of this environmental decline; of these factors, urban morphology appears as a major criterion of environmental optimization, which now focuses an important reflection inherent to the sustainability of the districts through their arrangements, forms and their configuration and organization modalities.

The studies carried out in this context took problematic approaches, dealing in particular with the impact of urban morphology on energy consumption (Murshed et al, 2019, Mouzourides et al, 2019), on aerodynamics aspects (Kent et al, 2019), on the heat island (Long et al, 2018) and the impact of albedo on energy consumption (Gregory and Kirchain, 2018). We can also mention studies on Urban energy efficiency through the highlighting of the importance of morphology in the energy efficiency of cities (Salat and Nowaski, 2010) and the impact of urban form on solar energy gains (Gauthier, 2014). We can say that while the energy dimension has been widely studied on an urban scale, we cannot say the same about the environmental dimension in terms of impact generation.

The present work aims to address the sustainability of a retirement district in France by seeking the most optimal morphology for environmental preservation through the influence of three criteria, namely, shape, compactness and density, on the generation of environmental impacts and then identify the contribution of the different sources of impacts to the overall assessment through a series of simulations based on the very rigorous Life Cycle Assessment (LCA) approach.

Life cycle extension of damaged pipelines using fiber reinforced polymer matrix composite wraps

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The life time management and the life cycle extension of different structural elements and structures is one of the most important technical-economic problems nowadays. High pressure, hydro-carbon transporting pipelines have strategic importance, accordingly their safe and practically failureless operation is elemental economic interest. For the developing both an Integrity Management Plan (IMP) or a Pipeline Integrity Management System (PIMS) for transporting pipelines, different data, frequently experimental data should be collected and evaluated. The direct purpose of the paper is to present the role of external reinforcing technics on the life cycle extension of damaged transporting steel pipelines, based on full scale tests.

Externally reinforced seamless and seam welded (HFW) steel pipeline sections without girth welds were investigated; fatigue (100 000 cycles) and following that, burst tests were executed. Different fibre reinforced polymer matrix composite wrap systems were used for the reinforcing of the artificially damaged pipelines. Both separate and interacting metal loss defects – longitudinal and circumferential gouges, through holes – were investigated as artificial flaws. Safety factor was calculated after the investigations, which means burst pressure divided by Maximum Allowable Operating Pressure (MAOP). The safety factor is applicable for the assessment of the effectiveness of the different reinforcing systems, furthermore for the ranking of these systems.

Innovative solutions for the building industry to improve sustainability performance with Life Cycle Assessment modelling

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The Life Cycle Assessment for cement as binder and concrete base material is an important part of the total LCA of buildings. In the LCA Research Team at University of Miskolc the total life cycle model of buildings has been developed in a complex way from the production phase of cement and concrete through the phase of usage to the end of life stage with consideration of the information models of the Environmental Product Declaration. Within the total lifecycle, the cement production phase and the end-of-life phase play an important role, because cement production is responsible for 8 % of global carbon-dioxide emissions. With the application of LCA software GaBi 8 thinkstep for the production technologies, their environmental efficiency can be determined. After the development of the LCA model for the production of cement and concrete elements, the possible innovative solutions for improving sustainability performance are presented by quantifying environmental impacts and energy optimization. Despite the fact that building industry and environmental management are closely interlocked, there is fairly poor national and international professional literature available about the two connected professions.

Investigation of different foam glasses with Life Cycle Assessment method

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Foam glass is an increasingly popular material which is applied mainly in the construction and building industry. Despite the fact that waste management and building industry are closely interlocked, there is fairly poor international professional literature available about the two connected professions. The aim of the research is to investigate the process of producing glass foam from glass waste according to the Lice Cycle Assessment method. This method is chosen because the lifecycle approach to waste management and circular economy is in the focus of the EU. The goal is basically to reduce emissions and move towards a resource-efficient society. The new circular economy package of the EU sets out ambitious recycling targets for the member countries. The package envisaged is a common EU target for recycling 65% of packaging waste by 2025, and 70% by 2030. The targets for glass waste is 70 % and 75 %, respectively. Since the glass is recyclable in 100 %, the glass waste is the target material of this study. After the separation phase - from metal and paper – the shredded and milled glass powder is mixed with SiC as foaming agent and fired in a laboratory furnace between 750 - 950 °C, for 10 or 30 minutes.

For the laboratory experiments the following types of waste glass was used:

1. ampoule glass

2. packaging glass

3. float glass

4. crystal glass

Both the properties of the glass (density, thermal conductivity, strength, and microstructure) and the total life cycle of glass waste are examined. For Life Cycle Analyses, Gabi 8.0 thinkstep software is used. As a result of this study, the waste preparation process can be optimized and the best foam glass type can be determined.

Circular economy solutions for industrial wastes

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The concept of circular economy (CE) has been in the centre of the strategical thinking since 2015 and numerous practical initiatives are in progress. It is expected in Europe to promote economic growth by creating new businesses and job opportunities, saving cost of materials, dampening price volatility, improving security of supply while at the same time reducing environmental pressures and impacts. It has been estimated that eco-design, waste prevention and reuse can bring net savings for EU businesses of up to EUR 600 billion, while at the same time reduce greenhouse gas emissions.

This study is based on Hungarian case studies where more successful circular solutions of industrial waste treatment have been implemented. One of them is a solvent regeneration from waste water to reuse it after distillation process. It is considering a chemical factory, that produces arsenic, phosphorus, iodine and fluorine removal absorber for drinking and technological waters. The production resulted daily 1 m3 waste water with 20 % DMSO solvent, collected and transferred to the incineration plant to be burned. After the new distillation process and analytical measurements both the solvent and water turned back to the production process and have been closed loop. The sustainability analysis which is mostly based on Life Cycle Sustainability Assessment resulted about 15 -20 percent benefit compared to linear technological process.

The other studies are based on the best circular practices of two Hungarian waste flows in the CIRCE2020 project. This project aims to facilitate a larger uptake of integrated environmental management approach in five specific Central European industrial areas by changing patterns from single and sporadic company recycling interventions to an integrated redesign of industrial interactions based on the concept of circular economy. The project aims to change the economic path from linear economy to circular economy. The comparison of the different scenarios has been carried out by LCA and LCC methods and we calculated PEF-based indicators of circular scenarios too both of recipient and donor side. The investigated waste flows were the rubber waste of tyre production and the plastic waste of stoma bag production. The study gives a general picture about possible analytical methods that could help the decision making. The investigated case has shown that to find the best practice for treatment of waste flows requires complex system analysis based on LCA and LCC application.

Harmonised environmental and economic assessment of circular solutions with life cycle approach - a Central European collaboration within the CIRCE2020 project

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The CIRCE2020 project, supported by the Interreg Central Europe Programme, funded under the European Regional Development Fund, aims to widen the application of the circular economy (CE) concept in the Central-European region by introducing innovative solutions for the industrial waste management in order to reduce dependencies from primary natural resources within industrial processing. Within the project framework, the selected CE alternatives have been assessed and compared to "business as usual" solutions from technological-, environmental- and cost perspectives. The life cycle approach and related Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) methodologies were adopted to the project goals and specific guidelines were developed. A major challenge was related to the harmonization of the environmental and economic assessment, regarding mostly the definition of system boundaries and functional unit. The guidelines have supported case studies in Austria, Croatia, Hungary, Italy and Poland. The presentation describes the main features of the LCA guideline (developed by ETRA Spa with Ecoinnovazione Srl), the LCC guideline (developed by Bay Zoltán Nonprofit Ltd), the harmonisation process and the preliminary experiences of the project partners and their local LCA/LCC experts.

New approach for characterizing the "naturalness" of building materials

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About 87% of the life of a civilized population is spent in a built environment, so it is necessary and convenient to introduce an easy-to-use, quick evaluation process to charac-terize "naturalness" of building materials. With the help of the parameter "NAT-TECH" (NTgrad) we can try to give a more evident, more feasible tool for the designers, instead of complicated and expensive evaluation software. This is why the “weighted technical-ecological evaluation value” described in more details in this article, which can be de-duced from the graphical representation of the “NAT-TECH” (NTgrad) and three other eco-logical and three relevant technical parameters. If the listed features - suitably - are shown in a web graph, then the area covered by the chart can define by using a single numerical value – "weighted technical-ecological evaluation value” – which material is the most ap-propriate for the decision maker in the given technical - ecological environment.

Grouping and analyzing PLC source code for smart manufacturing

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Shortening market time a key in modern and smart manufacturing. Engineering design processes require reusing the existing knowledge from similar projects. Grouping the machines, the processes or project is in the engineer's interest for a long time. It is a challenging task to it in a smart, automated way. This requires computational intelligence and soft computing methods.

This paper deals with two approaches to utilise Group Technology in the field of Programmable Logic Controller (PLC) grouping. The first approach analyses the functionality of the machines to control. A mathematical model is presented, and a Genetic Algorithm Clustering (GAC) approach is used. This introduces a binary polycode coding system to formularize the problem. The effectiveness of the grouping is evaluated by measures suggested by the relevant literature. A computer algorithm is presented that is capable to execute the aforementioned task.

The second approach analyses the PLC source code. The evaluation criterion of the similarity is based on finding matching source code lines. The task is analogous with finding matching sequences in DNA. The proposed algorithm finds the longest matching code sequences by using the Smith-Waterman algorithm. The paper presents the algorithm in detail, including a source code language specific tokenization. Both approaches are explained by coding examples.

Environmental assessment of buildings in Sudan

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As a result of the high cost of modern building materials, more than millions of people live in a slum, which is about 14 % of the world population. On the other hand, residential buildings are responsible for 40 % of the GHG emission in the world. Sustainability in building design and construction is an ideal solution to eliminate and solve climate change and housing shortage issues. Due to the high cost of building industry in Sudan compare to the low GDP per capita sustainable building materials and technology must be applied and improved. The main objective of the research paper is to overview the sustainability concept and applying the life cycle assessment study for building construction and materials in Sudan. Comparison between two cases of study has been done in order to examine and check the life cycle assessment of building typology in Sudan. The first case study represents an accurate sustainable, low cost and eco-environment building technology, while the second one represents a modern building typology.

The effect of the damaged fibre reinforced polymer machine and vehicle components on the vibration decay rate

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Fibre reinforced polymer (FRP) components can show damages that are not visible after a heavy impact or crash, which can be a safety hazard during the operation without being detected. Damaged FRP components can be detected by means of acoustic damage detection methods. Present paper will classify this method and will present the theory and practice in detail of the measurement of vibration decay rate.

The innovation shell, and barriers of disruptive innovation

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If we look at the technological possibilities offered by breakthrough results in computer sciences, materials sciences or biotechnology, we expect robust changes to take place in our everyday life in the near future. According to the expectations these changes should reshape our society and economy in a major way. The possibilities offered by the breakthrough results, however, may only affect our lives if they are put to practical use. In our study we investigate the characteristics of the innovation process that creates the bridge between technological/theoretical possibilities, and practical innovations. We detect the main influencing factors that form the so called innovation shell. The innovation shell has three components: the corporate core (made up of ownership interests, managerial motivations, corporate culture and structure, and people); the innovation ecosystem (made up of research and financial infrastructure, and regulating institutions); and finally the values of customers and stakeholders. Some of these factors create barriers others create incentives for innovation. In this study, we focus on the former ones.

Introducing a FACTory concept to develop a data base for durability and sustainability of materials

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One of the major industrial questions arising when calculating the life cycle of a product is: how long will it last? Relating to the field of tribology (friction, wear and lubrication of systems, components and products), this translates into the following question: how fast does a surface wear and loose its performance? For decades, standardized test methods have been used to compare the relative wear resistance of materials, lubricated or not, but these methods have one large downside : they produce on test result per test, and often the tests are long. Consequently, very little relevant 'wear data' can be found in literature or databases and while a lot of other material properties are easily consultable, the relative wear resistance of new materials remains little known.

However, to be able to calculate and design products and components with better sustainability, it is essential to know the relative wear rates. This lack in information in the industry is being addressed by a novel concept: productionizing of the wear testing leads to a more time and resource efficient collection of data. For the first time, 'big data' principles are being applied in this field of technology. It has led to the concept and EU-project proposal of the 'FACTory': an integrated unit produces relative wear data at high efficiency, combines the results in a proprietary data lake, and provides comparative information to users via an artificial intelligence tool. The result of the project will be fast and cost-effective access to data that is currently not available in the industry. The first field of application are in brake materials (eco-friendlier, less particle generation), anti-wear properties of greases (more grease lubricated systems in future electrical vehicles), wear resistance of technical polymers (more plastic components for weight reduction in transportation) and durability of advanced coatings (lifetime prolongation and friction reduction of moving parts).

In this presentation, the need for the 'productionising' of testing is demonstrated and the 'FACTory' concept explained.

Lifetime analyses of S960M steel grade applying fatigue and fracture mechanical approaches

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Nowadays, the safety of different engineering structures (e.g. welded structures) is achieved by ensuring the structural integrity. The integrity analysis is based on information belonging to loading condition of the structure, to properties of engineering materials and their changes due to loading and environment, furthermore to material discontinuities resulting from production and/or operation. According to this information, the result of analyses can be evaluated and decisions can be made about the further operation or replace from use, or probably about the maintenance of the structural element. In this manner structural integrity is in strong connection with life-cycle analyses of a structure.

One of the driving intentions in the industry is weight decreasing of different engineering structures and applying innovative technologies for production of these structures. This means from eco-conscious point of view that the most important efforts are saving raw materials and reducing energy consumption. These basic aims can be reached in case of engineering structures by applying high-strength steels, which requires smaller wall thickness for keeping the same strength (or even higher) and which requires smaller welded joints due to the thinner wall in the structure. However, application of high-strength materials suggests questions about lifetime profit and operation difficulties due to possible material flaws, especially in welded structures.

In this study low-cycle fatigue properties of thermomechanically rolled high strength steel, S960M base material were investigated and the behaviour were compared with a lower strength common steel grade. Furthermore, fracture mechanical investigation, crack-tip-opening displacement method was applied to characterise the material behaviour for loading a structure with material discontinuities.

These investigations give information about the expected lifetime of the high-strength steel during cyclic loading by fatigue test, and during static loading by fracture mechanical investigation.

Efficient application of S690QL type high strength steel for cyclic loaded welded structures

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The mass reduction of engineering structures is one of the basic trends nowadays, which can be attained by applying high strength materials, frequently high strength steels. During the manufacturing of these structures, the main joining technology is the welding, and gas metal arc welding (GMAW) is the most frequently used fusion welding process. Furthermore, cyclic loads are the most dangerous loads, which occur in case of different engineering structures. Accordingly, the determination and application of different design limit curves is a global trend for the innovative and economic design and operation of the structures. The direct purpose of the paper is to present the determination of fatigue crack propagation design limit curves for 690 type high strength steel and their GMAW joints, under different mismatch conditions.

SSAB Weldox 700E steel was investigated under matching, overmatching and matching (root layers) / overmatching (filler layers) conditions (M, OM and M / OM, respectively). Böhler Union X85 and X90 filler metals were used under M and OM conditions, respectively. Fatigue crack growth tests were performed with tensile stress, sinusoidal loading wave form, at room temperature, and on laboratory air. Statistical approaches were used during the cutting of the specimens from base material and welded joints, and the determination of the design curves, too.

Based on the results and the applied method, fatigue crack propagation design limit curves can be determined for the investigated cases, using simple Paris law crack growth relationship. The determined design limit curves can be applied for engineering critical assessment and structural integrity calculations of cracked, cyclic loaded structures.

Improvement of the modern house's energy efficiency

in the region of In Saleh

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Earthen architecture has been abandoned in favour of time and replaced by new materials, earth is one of the most famous materials in the world for its thermal properties and wide availability [J. Dethier, 1981]. This abandonment has led to the loss of heritage, discomfort and over-consumption of energy, especially for regions with an arid climate. This state of affairs was actually noted by the experts as well as the occupants.

Algeria has to face a growing energy problem linked to the evolution of its demography[Marc côte, 2005], currently the building sector consumes more than 41 °/° of the country's total consumption. [APRUE, 2006]

In this context a thermal study was undertaken on a sample of the modern house in the region of In Saleh in southern Algeria, a region known for long periods of overheating. The sample chosen is a house of modern typology The house was built by cinder block and has undergone structural transformations. A traditional materials have been incorporated (adobe waste, earth mortar and palm date waste) either in the walls or in the roof.

This variety of composition of the constructive elements allowed us to make a comparative study of the thermal behavior of the different spaces according to their compositions, whose objective is the ; thermal evaluation of the modern house as well as the verification of the impact of the introduction of local building materials in the modern house.

Our study includes an experimental study; measurement companions were installed in the various spaces of the house during the summer and winter periods, and a dynamic thermal modelling using the pleaides+ comfie software.

Based on the experimental and theoretical results obtained during this study, it was found that the spaces in which local materials were integrated responded better to temperature fluctuations than those built in cinder block, the difference of temperature was estimated at 5°C, which improved the energy efficiency of the modern house with a 25% reduction in energy consumption.

The results obtained confirm those of the literature being earthen construction an adequate solution that improves the energy efficiency of housing in arid environments.

Innovative and efficient production of welded body parts from 6082-T6 aluminium alloy

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Innovation is progressive idea generation keeping in view of some issue or problem or observing some event while working on particular job that led to the generation of creative ideas, invention of new sequence of process, improvement of mechanism, wide range of application with similar mechanism in technology while considering mankind, climate change, sustainable development, better quality, affordable price etc. which is consider as effective solutions to many challenging issues. Recycling of aluminium is the key advantage to provide continues global growth, optimising environmental performance and sustainable development of this industry. AA6082-T6 (AlSi1MgMn) is medium strength and high corrosion resistant aluminium alloy. It is tempered, solution heat treated and artificially aged (T6) structural aluminium alloy (according to EN 485-2 standard). This automotive aluminium alloy is widely used for outer body panels which combine high strength with good formability. Physical simulation of HAZ helps in identifying suitable welding parameters like linear heat input on the selected material under the conditions of typical industrial process. In this paper, effect of special heat treatment (pre ageing, post ageing) of the recently developed Hot Forming and in-die Quenching (HFQ) process is used to compensate the Heat affected zone (HAZ) softening. Investigation were performed on 1 mm AA6082-T6 sheet by a Gleeble 3500 physical simulator with specific selected peak temperatures using Rykalin-2D model (thin plate) and with two linear heat input (100 J/mm and 200 J/mm). Then the most critical subzone (Tpeak= 380 °C) was selected for the further investigations. Three different heat-treating routes were programmed on the simulator: HAZ cycle + post ageing; solution annealing + HAZ cycle +post ageing; solution annealing + pre ageing + HAZ cycle, post ageing). Finally, the properties of the investigated HAZ subzone were examined by optical microscope and microhardness test.

Sustainability and Innovation

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It is widely known that nowadays the mankind is looking forward to serious challenges. The social, economic and environmental impacts of human activities have reached a sub-critical level and they raise serious questions about the sustainability of our lifestyle even in a shorter term. The most significant problems include shortage of food and good-quality water on the one hand and their wasteful consumption on the other, huge disparities in the quality of life between different parts of the world, climate change, decrease of biodiversity, overload of natural resources, both renewables and non-renewables and the challenges for the fourth industrial revolution.

In order to address all these issues and ensure a sustainable future for all of us, we have to change our way of thinking and have to promote innovation, which in broader term is a renewal process. It aims at development of significantly improved or brand-new products and technologies, novel marketing methods or introduction of new organizational systems.

The outstanding role of innovation in sustainable development was clearly formulated by the American economist, Robert Solow in his Nobel Prize lecture in 1987. In his formulation "the permanent rate of growth of output per unit of labour input is independent of the saving (investment) rate and depends entirely on the rate of technological progress in the broadest sense". The later term is a quite evident reference to innovation.

In this paper an attempt is made to outline the importance of innovation in the technical and economic development with special regard to problems of sustainability. The following subjects will be reviewed: the interactive model of innovation, the innovation as main driving force of economic development, the economy as background of innovation, the European Innovation Scoreboard, types and strategies of enterprise innovations and SWOT analysis of the Hungarian innovation environment. Selected examples will be presented on successful innovations and conclusions will be drawn on the general aspects of search for answers to the main challenges of sustainability.

Redundancy Analysis of the Railway Network of Hungary

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Rail transport is of increasing importance in Europe due to its environmentally friendly nature and efficiency in freight transport. However, disruptions can occur anytime and anywhere and if so, the rerouting of the trains has to be carried out as soon as possible either on the shortest or fastest route available. The question then arises: which are those railway lines that have to be continuously maintained in order to provide sufficient alternatives when needed?

The answer was looked for using graph theory. The railway network of Hungary was modelled by a weighted directed graph, the weights of the line sections being either their lengths or running times. The disruption of a line section was modelled by deleting the corresponding edge from the graph.

To determine which lines can serve as an alternative, the so-called redundancy importance measure was used. First, the shortest route was calculated between stations a and b in the undisrupted network. Then, for a disrupted v line section on this route, the alternative shortest route was determined, the length of which was denoted by l_ab^v. By also removing line section u, which is part of the shortest route in the disrupted network, but not in the undisrupted one, the route length increases to l_ab^uv. Then, the r_(l,ab)^uv redundancy that line section u provides to line section v is defined as:

r_(l,ab)^uv=l_ab^uv-l_ab^v.

By summing up the redundancy values for all v line sections and all ⟨a,b⟩ pairs of stations, the total r_l^u redundancy of line section u is obtained:

r_l^u=∑_v▒∑_⟨a,b⟩▒ 〖l_ab^uv-l_ab^v 〗 .

For running times, the r_t^u redundancy can be calculated similarly. Based on these measures, the individual line sections can be compared to each other.

The results show that the line section with the highest redundancy is the mostly single-tracked part of line 80 between Miskolc and Nyíregyháza. Lines 100/100a and 80/80a provide redundancy for each other through the transversal lines between them. Lines 2 and 4 could only be a possible alternative for line 1 and especially for the Southern Railway Bridge in Budapest if they were double tracked and electrified in their whole length. The alternative routes to Záhony, Lőkösháza and Pécs also have to be developed.

A short discussion on some influencing factors of an artificial corrosion system and obtained metallic pipe samples

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Twentieth century beginning witnessed the rapid emergence of steel and iron pipe transportation in process industries. At the same time, potable water reticulation metallic pipe has been at least around 100 years old and fully-grown up. There is a possible threat of stray current posing to metallic materials and structures in daily reality as well. Either salty, aqueous environments or the backfill soil in vicinity of distribution conduits usually encompasses oxygen, moisture content and is inadequately resistive to permit passage of electrical current; as a result, buried steel structures are subject to corrosion. As a result, these decaying infrastructures are raising concern to consumers, producers, legislators and regulators. Severely external corrosion problem is one of the most considerable interest, often attributed to the corrosiveness of the aggressive surrounding environment, particularly saline soil, commonly in coastal areas. Taking advantage of electrochemical machining, an artificial system was adopted to intimate potentially hostile environment to closely scrutinize corrosion behavior of steel pipes, enabling us to estimate the effect of some important factors such as degradation rate, inspected areas under similar exposure conditions. Some of these parameters are readily available in corrosion databanks after investigating experimentally 139 relatively identical specimens yielded from corrosion tests.