



ELEVCON 2021

The 23rd International Congress on
Vertical Transportation Technologies



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SPEAKER ABSTRACTS

TITLE: FUTURE OF ELEVATOR EMERGENCY COMMUNICATION AFTER TRADITIONAL FIXED LINES, 2G AND 3G NETWORKS SUNSET

AUTHOR(S): Pavel Kotek, Marek Loucký, 2N Telekomunikace a.s

COUNTRY Czech Republic

ABSTRACT: How to prepare for upcoming networks sunset?

How to analog to IP migration in elevator emergency communication?
Is video from the elevator car during emergency becoming the new standard?

All those topics will be answered, and possible approaches will be shown. Let me start with the current status. Elevator emergency communication was pretty much the same for past 15 years and the "only" technological change was usage of mobile networks instead of fixed lines (PSTN). Ahead of us is a change much bigger and that is a move from analog to digital, or IP if you prefer.

TITLE: SIMULATION BASED DESIGN OF TRANSPORTATION SYSTEMS IN BUILDINGS

AUTHOR(S): Henri Hakonen, Lic.Sc. (Tech.) & Juha-Matti Kuusinen, D.Sc. (Tech.), KONE Corporation

COUNTRY Finland

ABSTRACT: This paper describes some key advances in modeling and simulating people flow in buildings including multiple transportation and access devices such as elevators, escalators, staircases, turnstiles and doors. The flow consists of autonomous agents whose routes through the building depend on their physical and behavioral characteristics such as walking speed, the ability to use certain devices and preference about different route alternatives. These computational simulation models are combined with game engine technology for realistic agent movement, high-quality 3D visualizations and easier assessment and communication of the simulation results enabling the design of better functioning buildings.

TITLE: **FROM R&D TO BIM IN THE ELEVATOR INDUSTRY**

AUTHOR(S): **Andreas Fleischmann**, DigiPara AG

COUNTRY Germany

ABSTRACT: The building contractors demand to be part of the BIM process has reached elevator companies. Sending a 3D BIM model might have been sufficient in the past, in the future the BIM process must be lived inside the whole elevator company. Automated processes between R&D, suppliers, drafting and sales department will become more and more important in the future. Andreas Fleischmann explains the challenges and opportunities for the elevator industry.

TITLE: **DISCUSSION ON EXPRESS ZONE AND DESTINATION CONTROL FOR UP PEAK TRAFFIC**

AUTHOR(S): **Shingo Kobori, Takahiro Ishikawa, Takayoshi Okunaka, Yasuhiro Yokoi, Naohiko Suzuki**, Mitsubishi Electric Corporation

COUNTRY: Japan

ABSTRACT: There is peak hour when a number of passengers converge the entrance floor of office in morning.
To transport them to the destination efficiency, Some efforts are made to the elevator group control system.
Traditional one is the express zone, in which passengers with the destination in the same zone are collected in the same car.
The other is the destination control, in which passengers with the same destination are collected in the same car.
The paper shows the formulation of the handling capacity for each effort and the combination of both efforts, and the characteristics of them.

TITLE: **DIGITAL ELEVATOR SURVEY – IMPROVING MODERNIZATION SITE SURVEYS**

AUTHOR(S): **Darren Batey**, KONE Industrial Ltd

COUNTRY Finland

ABSTRACT: An accurate site survey is the first step in creating a successful engineered modernization. In the past site surveys have used tape measures and pen and paper, this has recently been changed to use laser measurements and mobile devices but basically the process has remained the same just the media has changed. For complex projects KONE have started to use 3D scanning to improve the site survey accuracy, minimise disruption to our customers, improve the safety of our personnel and increase overall productivity of the engineering.

TITLE: **NEW TECHNOLOGIES IN LIFTS - IoT, BIGDATA, ARTIFICIAL INTELLIGENCE. STANDARDIZATION PERSPECTIVES**

AUTHOR(S): **Alfredo Gómez**, Instituto Tecnológico de Aragón - ITAINNOVA

COUNTRY Spain

ABSTRACT: A new digitalization wave is spreading across all industries. This wave, riding on technologies such as IoT, BigData and Artificial Intelligence is transforming industrial companies and the products, and services they offer to the market. The lift industry is also affected by this process but the impact of all these technologies and its capacity to transform business models is sure, but not yet well measured. As the advance of these technologies is unstoppable, standardization in this field will help companies to take advantage of these new possibilities while keeping appropriate safety levels for user and workers. This paper tries to foresee the impact of IoT, BigData and Artificial Intelligence on lifts and presents an overview of existing cross-sectorial standardization activities regarding these technologies. Reference to the new ISO adhoc group ISO 178 AHG New Technologies for Lifts, is included.

TITLE: **ANTIBACTERIAL COATING WITH SILVER NANOPARTICLES FOR ELEVATOR COMPONENTS**

AUTHOR(S): **Ioanna K. Sfampa**¹ Engineering Research Department, KLEEMANN Lifts, **Iraklis Chatziparasidis**^{1,2} Mechanical Engineering Department, University of Western Macedonia, **Afrodite Vlachou**³ PLiN Nanotechnology SA, Thermi, **Alexander Tsouknidas**³ and **Nikolaos Michailidis**^{3,4} Physical Metallurgy Laboratory, Mechanical Engineering Department, AUTH

COUNTRY: Greece

ABSTRACT: The development and spread of resistant microorganisms' strains on daily used objects poses a threat to global health. The daily use of elevators necessitates the protection of the users, especially on high microbial load surfaces, as the call-buttons. According to the literature, using certain metals as silver (especially in the nanoscale), prevents the growth and spread of various microorganisms. The objective of this work is to benefit from the antimicrobial action that silver nanoparticles (AgNPs) offer, and according to an innovative approach, to produce nanocomposite coatings containing embedded nanoparticles and also to apply these coatings to demanding points of interest as the elevator cabin.

TITLE: **BRAIN-CONTROLLED ELEVATORS**

AUTHOR(S): **Iraklis Chatziparasidis**^{1,2}, Engineering Research Department, KLEEMANN Lifts, Mechanical Engineering Department, University of Western Macedonia, Greece, **Ioanna K. Sfampa**¹ Engineering Research Department, KLEEMANN Lifts

COUNTRY: Greece

ABSTRACT: Brain-computer Interfaces (BCI) are systems that use signals recorded from the brain to enable communication and control applications. One of the most important applications of BCI technology is that enables people who are severely paralyzed by amyotrophic lateral sclerosis, brainstem stroke, or other disorders to communicate, operate computer programs, or even control numerous devices. At the same time, elevators are probably the best option for disabled persons to gain

extra access and mobility within a house or a building. In this paper, a prototype application and an experimental setup for a BCI system for controlling an elevator is presented.

TITLE: **EARLY RECOVERY SUPPORT SYSTEM FOR ELEVATOR FAILURE USING AI**

AUTHOR(S): **Masakazu Kon, Yutaka Maruoka**, Hitachi Building Systems Co., Ltd

COUNTRY: Japan

ABSTRACT: Hitachi Building System has been working for many years on one of the most important problems, shortening the recovery time from elevator failures. As the latest efforts, to improve our maintenance service, we have developed and introduced a new recovery support system from elevator failures that enables engineers to resolve problems without highly professional know-how and experience. The system estimates causes of the failures and present them in descending order of probability, by using AI (Artificial Intelligence) based on analysis of elevator control signals and failure codes output from elevator remote monitoring systems, as well as past failure case data.

TITLE: **COMPARE STUDY ON THE PERFORMANCE OF ACOUSTIC INSULATION ELEMENT FOR GUIDE RAIL CONNECTIONS USING ANCHOR CHANNELS WITH CHANNEL BOLTS**

AUTHOR(S): **Mazen Ayoubi¹, Benjamin Gottschalk²**, JORDAHL GmbH

COUNTRY: Germany

ABSTRACT: The resulting operational noise of elevators can be an acoustical impairment to the usability of rooms in the vicinity of the elevator shaft. The available technological efforts to acoustically insulate elevator components are not able to prevent significant transmission of noise and vibration to the elevator shaft walls. The JORDAHL Acoustic Insulation element is designed to decouple the transmission chain of noise and vibration, and so to prevent the vibro-acoustic transmissions reaching the elevator wall and building structure. Compare study on the performance of this element using acoustic tests taking into account the other nowadays available elements and solutions have been carried on different types of JORDAHL Acoustic Insulation. The most important scientific and practical results of the investigations, will be summarized and discussed.

TITLE: **AUTOMATIC DETECTION OF OBJECTS BLOCKING ELEVATOR DOORS USING COMPUTER VISION**

AUTHOR(S): **David Baumgartner¹, Ignace Jordens², Daniel Wilfing³, Oliver Krauss¹, Gerald Zwettler¹**, ¹University of Applied Sciences Upper Austria-Research Group: Advanced Information Systems and Technology (AIST), Austria, ²PXL University of Applied Sciences and Arts, Belgium, ³VIEW Promotion GmbH – Research & Development - Austria

COUNTRY: Austria & Belgium

ABSTRACT: In this paper, we present a new approach combining computer vision with depth perception cameras to map the interior of the elevator, detect the position and the state of the door and find objects in the door area. The depth data is used to detect a security cube (position of the door, layout of the elevator, etc.), while color data further enhances the detection of new objects. The approach can detect the state of the elevator door (open, closed), while no object is blocking the view to the door, as well as successfully identify objects blocking an open door.

TITLE: **ENHANCING ESCALATOR SAFETY WITH THE USE OF OPTICAL-FIBER SENSING TECHNOLOGY**

AUTHOR(S): **William T.W. Au¹, W.H. Chung^{2, 3}, K.C. Cheng², Y.H. Foo², H.Y. Au³, H.Y. Leung³, H. Y. Tam³**, ¹The Electrical and Mechanical Services Department, Government of the HKSAR, ²Avaron Technologies Limited, ³The Hong Kong Polytechnic University, HKSAR

COUNTRY: Hong Kong, China

ABSTRACT: Reliable and safe operation of escalators is crucial for every metropolitan city. Sensing systems making use of optical-fibers can effectively and reliably monitor the operation of an in-service escalator to tell if there are impending equipment failures or breakdowns, capable of giving advance notices for corrective measures to enhance reliability and availability of escalators. A novel design of optical-fiber sensing and data analytic approach capable of early identification of faults, including brake malfunction, step dislocation due to jamming of foreign objects, defective step rollers and handrails has gone through its proof of concept testing. Abnormal noise signatures for an escalator in a metro-station have been recorded and analysed to signify impending failures of escalator components, thus enabling early rectification of the defective parts and eliminating of passenger injury or equipment damage due to failure of the defective component. Coupled with artificial intelligence, the system forms an important platform for advancing the capability of preventive maintenance and helps relieve the burden of servicing personnel for escalators.

TITLE: **ESTIMATION OF PARAMETERS AFFECTING RIDE COMFORT IN ELEVATOR**

AUTHOR(S): **Yoshitake Kamijo, Yoshiyuki Iwata, Hajime Takada**, Toshiba Infrastructure Systems & Solutions Corporation

COUNTRY: Japan

ABSTRACT: Among the demands for energy saving and high efficiency improvement of equipment, comfort is required as added value. In this paper we focus on the ride comfort of the elevator. We combine human subjective evaluation and objective evaluation by physical quantity to extract parameters that affect ride comfort. As a method, each index is extracted by multivariate analysis of sensory evaluation data and physical evaluation data, and they are subjected to multiple regression analysis to make association. As a result, this paper shows that the parameter to be affected is longitudinal acceleration of the human being.

TITLE: **INTELLIGENT MONITORING OF ELEVATOR BRAKES**

AUTHOR(S): **Alexander Hutler**, Chr. Mayr GmbH + Co. KG

COUNTRY: Germany

Abstract: An electromagnetic safety brake is traditionally equipped with a release monitoring system to detect if the brake is closed or open. This alone, however, is not enough to meet "industry 4.0" and future predictive maintenance requirements.

New electrical solutions with modern elevator brake systems meet future requirements.

The ROBA-brake-checker module by Mayr power transmission is able to supply and monitor new safety brake types. And it does so without the use of sensors. This system makes safety visible, so to speak. And maintenance becomes plannable. The module itself is now able to provide detailed information on the condition of the brake. If regular maintenance procedures have no longer to be carried out by service personnel, customers are able to save a lot of money.

TITLE: **DIVIDER BEAM DESIGN AS PART OF THE STANDARD ELEVATOR DESIGN**

AUTHOR(S): **Dr. sc. techn. Michael Merz**, Hilti Corporation

COUNTRY: Liechtenstein

ABSTRACT: Divider beams can create headaches for project managers who must provide separation walls in a hoistway that should host two or more elevators. To avoid accidents during the handling and welding of heavy steel material, the installation of the beams is often passed to the general contractor or a subcontractor. Involving a third party requires design drawings, a bidding process, coordination, inspection for acceptance and, finally, the complaint procedure.

This paper introduces a new design method for installing divider beams as part of the elevator installation process and discusses the multiple benefits of this innovative solution.

TITLE: **DESIGN CHALLENGES IN ASIA DUE TO MANUFACTURERS' DIFFERENCES**

AUTHOR(S): **K Rajah Venkatraman; Vinay Venkatraman**, Fortune Consultants

COUNTRY: India

ABSTRACT: The Consultant faces a challenge by the developer/architect in providing space for vertical transportation. For example, often floor plates and high density become limiting factors for VT Design. Additionally, in Asia, different suppliers/manufacturers have their design constraints which calls for different dimensional and other requirements varying between each other. These and other differences between suppliers are the challenges listed out as major difficulties for

the consultant in achieving optimal design. To strengthen this argument and to look for a commonality between the suppliers, various segments are being logically presented in the paper touching upon the various aspects of VT Design.

TITLE: **SHORTENING AN INSTALLATION PERIOD FOR ELEVATOR MODERNIZATION**

AUTHOR(S): **Takeshi Katsura (Presenter), Tomohiro Murayama, Shinji Inaida**, Toshiba Elevator and Building Systems Corporation

COUNTRY: Japan

ABSTRACT: During the years of asset-inflation economic bubble in Japan, the late 1980's, a large number of elevators were originally constructed. Those elevators are approaching their service life limit caused by aging. Building owners request us to modernize the elevators with a possible short installation period in order to avoid inconvenience to users during downtimes. To solve the problem, Toshiba Elevator and Building Systems Corporation has revalued reusability of the existing components and upgraded the components' design and retrofit process so as to realize the minimum 3.5-days installation (two days of all day downtime and 1.5days of temporary downtime) by a two-person work team.

TITLE: **AN HISTORICAL OVERVIEW OF MULTIDIRECTIONAL, CABLE-LESS ELEVATOR SYSTEMS**

AUTHOR(S): **Dr. Lee E. Gray**, UNC Charlotte

COUNTRY: United States

ABSTRACT: Every profession embraces a set of elusive goals that constitute what may be thought of as "Holy Grail" projects. For the vertical transportation industry this includes the search for an elevator system that moves passengers vertically *and* horizontally through a building. The 100-year history of these efforts includes thyssenkrupp's contemporary development of MULTI. The modern, ongoing, search for this particular Holy Grail suggests that an historical overview could provide a useful lens through which to understand contemporary events. This paper will explore the proposed solutions to multi-direction elevator systems and, perhaps of equal importance, the problem(s) they sought to solve.

TITLE: **ELEVATOR 4.0 (IOE-INTERNET OF ELEVATOR)**

AUTHOR(S): **Adem Dogan**, UCTEA Chamber Of Mechanical Engineers

COUNTRY: Turkey

ABSTRACT: The use of Internet of Things devices, which is one of the main structures of the Industry 4.0 concept, which leads the developing industry sector in the world, is rapidly increasing. For the efficient and safe operation of elevators, it is important to apply this technology to elevator systems. In this study, elevator systems were examined and an example Internet of Elevator (IoE) system was developed and applied to buildings within the boundaries of a municipal district on a minor scale. Information about Predictive Maintenance, Zero DownTime will be transferred to

valuable participants through the data that is generated during this application and the information that IoT devices are transferred to a Cloud system.

TITLE: STATE-OF-THE-ART AND FUTURE OF SAFE SHAFT INFORMATION SYSTEMS

AUTHOR(S): Dr.-Ing. Stephan Rohr, ELGO Batscale AG

COUNTRY: Liechtenstein

ABSTRACT: With the introduction of PESSRAL in the European Standard the future of safety systems started to be part of elevators. The absolute positioning device becomes a more and more important role on that because with a safe position and speed a lot of the SIL rated functions can be implemented. To mention some : Unintended car movement, Terminal slow down, inspection supervision and a lot more. This paper gives an overview of the safety functions which are available on the market and an outview to the future of safety functions.

TITLE: STUDY ON LINEAR PERMANENT MAGNET SYNCHRONOUS MACHINES FOR ROPELESS LIFTS

AUTHOR(S): Albert So¹ and W.L. Chan², International Association of Elevator Engineers (HK-China Branch), ¹University of Hong Kong, ²Hong Kong Polytechnic University

COUNTRY: Hong Kong

ABSTRACT: It is rather certain that multi-dimensional lift systems will soon dominate the lift industry in coming years due to the first successful development of MULTI™. To facilitate such a design, the concept of ropeless lifts has to be implemented while the adoption of linear permanent magnet synchronous machines (LPMSMs) such as those used in the MULTI™ system is an obvious choice. Without the existence of hoisting ropes, lift cars not only can travel along all three directions, but the number of which in one hoistway is not limited to two. We carried out a series of academic studies to evaluate the performance of such LPMSMs under various conditions by simulation. In this paper, the control method to realize the required kinematics under a full-load up journey, the impact of different electrical parameters on the power consumption, and most important, the analytical solution associated with emergency operation under a genuine power failure will be discussed. Machine models of surface mounted and salient permanent magnets will also be considered.

TITLE: EXPERIMENTAL DETERMINATION OF DEFLECTIONS AND STRESS IN GUIDE RAIL FIXTURES

AUTHOR(S): Adem Candaş¹, Eren Kalay², C. Erdem İmrak³, Sefa Targıt⁴,
^{1,2,3}ITU Faculty of Mechanical Engineering, ⁴ASRAY Company

COUNTRY: Turkey

ABSTRACT: Guide rails and joint components are significant elements of an elevator system in terms of ensuring safety travel. Bending and buckling stresses are observed due to the loads acting on the guide rails and their fasteners under excessive conditions such as earthquake. In this study, according to EN 81-20, stress and deformations occurred on the joint points and guide rails are calculated and these results are compared with the test data. A hydraulic test setup is designed and constructed for simulating seismic effect of an earthquake.

TITLE: **WIRE ROPE ISOLATORS AND THEIR USAGE IN LIFTS: AN INNOVATIVE APPROACH**

AUTHOR(S): **Eren Kayaoğlu¹, Adem Candaş², C. Erdem İmrak³**, ¹Okan University Vocational School, ^{2,3}ITU. Faculty of Mechanical Engineering

COUNTRY: Turkey

ABSTRACT: The wire rope isolator (WRI) is made of stainless-steel strands of cable threaded through retaining bars or circular pieces which are made of aluminium alloy or steel. When the strands; that are clamped into retaining parts; flex from vibration input or shock impulse, they convert kinetic energy into thermal energy by means of Coulomb friction, which then dissipates to ambient. This protects whatever product the wire rope isolator is cushioning as it acts to decouple the equipment from the vibration or shock source. There are a number of spots that wire rope isolators can be used in elevator systems.

TITLE: **THE SIMULATION OF SEISMIC EFFECT ON GUIDE RAIL FASTENERS AND RE-DESIGN OF BRACKETS**

AUTHOR(S): **Abdül Melik Sancak¹, Adem Candaş², Oktay Azeloglu³, C. Erdem İmrak⁴**
¹ITU Graduate School of Science Engineering & Technology, ^{2,4}ITU Faculty of Mechanical Engineering, ³YTU Faculty of Mechanical Engineering

COUNTRY: Turkey

ABSTRACT: The brackets that connect and secure the elevator car and counterweight rails to the walls of the concrete elevator shaft are damaged as a result of the seismic waves. Hence, elevators cannot be used because the car and counterweight of the elevator cannot run on the rails. Critical buildings such as hospitals, public and equipment that need to be evacuated after an earthquake can be hardly transported. In this study, simulations were conducted to determine the effect of earthquake loads on the bracket parts. Finally, bracket elements were re-designed to withstand earthquake loads to use the elevator after being affected.

TITLE: **COMPUTER-AIDED MODELLING, ANALYSIS, AND DESIGN OF GLASS PANELS OF RUNNING CAR**

AUTHOR(S): **Eren Kalay¹, Adem Candaş², C. Erdem İmrak³**
^{1,2,3}ITU Faculty of Mechanical Engineering

COUNTRY: Turkey

ABSTRACT: In the contrast with the past, there is a growing trend to increase the transparency of buildings. With the developing technology now, it is possible to see this trend in lifts also. Increasing glass industry has revealed the term structural glass that consists of two tempered glass with the layer of PVB. Designers have created four-point fixed glass facade system for lifts with using the structural glasses to increase aesthetic view. But fixed holes create stress concentration that could lead to catastrophic failures. The aim of this paper is to investigate stress distribution around the drilled holes of lift glass facade while running.

TITLE: **VERTICAL HIGH SCHOOLS – THE FUTURE OR FAILURE?**

AUTHOR(S): **Scott Hampson**, Arup

COUNTRY: Australia

ABSTRACT: Arthur Phillip High School is in a high growth area in Sydney's western suburbs. Designed by Grimshaw Architects the school will accommodate 2000 students plus 150 teachers over 18 floors. Considering the building population and height, Arthur Phillip high school may be the world's most technically challenging vertical-school. Arup was engaged to deliver a vertical transportation solution that would meet the performance requirements of stakeholders while also being considerate of spatial and cost constraints. My paper will review the project and address our design approach, challenges, solutions and final operation.

TITLE: **CONDITION MONITORING OF ELEVATOR USING DEEP LEARNING AND FREQUENCY ANALYSIS APPROACH**

AUTHOR(S): **Krishna Mohan Mishra¹, John-Eric Saxen², Jerker Bjorkqvist², and Kalevi J. Huhtala¹**, ¹Unit of Automation Technology and Mechanical Engineering, Tampere University, Tampere, ²Department of Information Sciences, Abo Akademi University, Turku

COUNTRY: Finland

Abstract: In this research, we propose automated deep learning feature extraction technique to calculate new features from fast fourier transform (FFT) of data from an accelerometer sensor attached to an elevator car. Data labelling is performed with the information provided by maintenance data. Calculated features attached with class variables are classified using random forest algorithm. We have achieved 100% accuracy in fault detection along with avoiding false alarms based on new extracted deep features, which outperforms results using existing features. This research will help various predictive maintenance systems to detect false alarms, which will in turn reduce unnecessary visits of service technicians to installation sites.

TITLE: **VERTICAL EQUIPMENT MAINTENANCE**

AUTHOR(S): **John W Koshak**, QEC, CEI, Elevator Safety Solutions, LLC

COUNTRY: United States

ABSTRACT: The Safety Code for Elevators and Escalators in the United States and Canada, ASME A17.1/CSA B44, includes Section 8.6, the Maintenance, Repair, Replacement and Testing section. It applies to all new and existing equipment to ensure maintenance is performed on critical components of vertical equipment to reduce hazard. It prescribes a Maintenance Control Program (MCP), a documented set of maintenance tasks, procedures, examinations, tests and records to ensure that equipment is maintained in compliance with the requirements of Code. It requires establishing the intervals between performing a maintenance task, recording maintenance performed, recording repairs, replacements, alterations, call backs, oil loss, and several other items. Authorities Having Jurisdictions in the United States and Regulatory Authorities in Canada (AHJs/RAs) require owners to provide and follow these important programs. This paper details using a system that fully complies with these requirements, eMCP.

TITLE: **HOW TO SETUP SAFETY DEVICES IN AN ELEVATOR (WORKSHOP)**

AUTHOR(S): **Dr.-Ing. Stephan Rohr**, ELGO Batscale AG

COUNTRY: Liechtenstein

WORKSHOP In this workshop an overview is given how to setup a safety device (Limax3CP) from scratch. How to program the safety parameters as well as how to setup the device for commissioning, learn the shaft parameters (teach process) and set the elevator to normal running mode. Discussion of safety functions which are good to use and which are complicated is welcome.