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# Part I CET 2016 Conference Schedule

**Time:** October 21-October 23, 2016

**Location:** Guangdong Hotel (Shanghai), Shanghai, China

Date	Time	Lobby, Guangdong Hotel (Shanghai)
October 21	14:00-17:00	Registration
Date	Time	Kapok Room (木棉厅)
October 22	08:30-12:00	<p><b>Invited Session:</b></p> <p>Prof. Eng Chew , Prof. Peng-Sheng Wei, Prof. Stanislaw Migorski, Prof. Luigi de Luca, Prof. Junhui Hu, Prof. Hsien-Hua Lee</p> <p>Chair: Prof. Peng-Sheng Wei</p> <p><b>Group Photo &amp; Coffee Break:</b> 10:30-10:50</p>
	12:00-13:30	<p><b>Lunch</b> Shanghai Room[上海厅] 2<sup>nd</sup> Floor</p>
	14:00-18:00	<p>Kapok Room (木棉厅)</p> <p><b>Technical Session 1:</b> <b>Engineering and Technology I</b></p> <p>Chair: Prof. Mihály Pituk</p> <p><b>Group Photo &amp; Coffee Break:</b> 16:00-16:15</p>
	18:00-19:30	<p><b>Dinner</b> Shanghai Room[上海厅] 2<sup>nd</sup> Floor</p>
October 23	08:30-12:00	<p>Kapok Room (木棉厅)</p> <p><b>Technical Session 2:</b> <b>Engineering and Technology II</b></p> <p>Chair: TBD</p> <p><b>Group Photo &amp; Coffee Break:</b> 10:00-10:15</p>
	12:00-13:30	<p><b>Lunch</b> Shenzhen Room[深圳厅] 2<sup>nd</sup> Floor</p>
October 24	08:00-18:00	One-day Tour (at own expense)

## Part II Invited Speeches

### Invited Speech 1: Industry-based engineering and business entrepreneurship

#### education: a Chinese Model

**Speaker:** Prof. Eng Chew, University of Technology Sydney, Australia

Prof. Ping Shuai, Shanghai University, China

**Time:** 08:30-09:10, Saturday Morning, October 22, 2016

**Location:** Kapok Room (木棉厅), 4th Floor, Guangdong Hotel (Shanghai)

#### Abstract

In today's increasingly digitalized world, entrepreneurial innovations of any type, whether product, service or business model, are often the outcomes of collaboration by cross-disciplinary experts. To educate the next generation of entrepreneurs, then, requires higher education institutions to not only engage externally with select industry partners (entrepreneurs) but also build internal collaboration between different disciplines, such as engineering and business, to co-develop and co-create entrepreneurship education programs in line with industry needs. These programs will teach young college students to learn the art and science of entrepreneurship by "doing". They will enable cross-disciplinary students to self-select forming a collaborative team to "innovate" by solving a real-world problem identified by an industry partner. The students will learn the practice of entrepreneurship by acting as an "entrepreneur team" who, under the mentorship of the industry partner and a faculty, will attempt to develop and commercialize the innovative solution by progressing through the typical end-to-end innovation processes of ideation, selection (prototyping and/or proof-of-concept), implementation, commercialization and review (learning). Each "entrepreneur team's" performance is proactively monitored, analysed and shared amongst the students by the faculty and industry mentor. Both success and failure are regarded as valuable learning experiences and represented as contrasting exemplars of "good" and "bad" entrepreneurial practices respectively. For business students the program offers them exposure to learn new technological ideas from engineering students for co-solving real-world problems. Conversely, engineering students learn from the business students how to design business model and commercialise their technological ideas. Importantly, the program offers the industry partners access to diverse skilled resources for solving their problems and potentially creating a new business from the solution. This keynote describes a case study research of such an entrepreneurship education program being run by Shanghai University.

## Invited Speech 2: Effects of Solute Gas Transport on Controlling Pore Shape in

### Solid

**Speaker:** Prof. Peng-Sheng Wei, National Sun Yat-Sen University, Chinese Taipei

**Time:** 09:10-09:50, Saturday Morning, October 22, 2016

**Location:** Kapok Room (木棉厅), 4th Floor, Guangdong Hotel (Shanghai)



#### Abstract

Porosity is one of the most serious problems commonly occurring in weldments. In order to remove and control porosity, understanding its formation is important. A pore formed in solid is a consequence of a bubble nucleated by supersaturation and entrapped by a solidification front. By accounting for transport of mass, momentum and physico-chemical equilibrium of solute gas across the bubble cap, it is found that pore formation can be categorized into three cases due to different mechanisms responsible for directions of solute gas transport. Different directions of solute gas transport influence the variations of gas pressure in the pore and its pore shape with time in order to satisfy balances of pressures, physico-chemical equilibrium at the top cap, and the equation of state in the pore. This study has provided an exploratory and general analysis for controlling pore formation in solids.

## Invited Speech 3: Design and performance evaluation of piezo-driven synthetic jet devices Luigi de Luca and Matteo Chiatto

**Speaker:** Prof. Luigi de Luca, University of Naples Federico II, Italy

**Time:** 09:50-10:30, Saturday Morning, October 22, 2016

**Location:** Kapok Room (木棉厅), 4th Floor, Guangdong Hotel (Shanghai)



#### Abstract

In the last few years synthetic jet actuators have gained much interest among flow control techniques due to their short response time, high jet velocity and absence of traditional piping, that matches the requirements of reduced size and low weight. A synthetic jet is generated by the membrane oscillation (generally driven by a piezo-electric element) in a relatively small cavity, producing periodic cavity pressure variation associated to cavity volume change. The high pressure air exhausts through an orifice, converting membrane elastic energy in jet kinetic energy. This review paper faces the development of a validated lumped-element modeling (LEM) as a practical tool to design and manufacturing actuators. LEM can predict quickly device performances such as frequency response in terms of membrane displacement, cavity pressure and jet velocity, as well as efficiency of energy conversion of input Joule power into useful kinetic power of air jet. Actuator performance is analyzed also by varying

typical geometric parameters such as cavity height and orifice diameter and length, through a proper dimensionless form of the governing equations.

## **Invited Speech 4: Acoustic Streaming Eddies in Ultrasonic Nano Manipulations**

**Speaker:** Prof. Junhui Hu, Nanjing University of Aeronautics and Astronautics, China

**Time:** 10:50-11:30, Saturday Morning, October 22, 2016

**Location:** Kapok Room (木棉厅), 4th Floor, Guangdong Hotel (Shanghai)



### **Abstract**

Nano manipulation technology has wide potential applications in the micro/nano measurement and assembling, fabrication of high-end microelectronic and photonic devices, high-sensitivity sensing, treatment of biomedical samples, etc. Ultrasonic nano manipulation is a new manipulating technology which emerged in 2012. It has the merits such as low temperature rise at the manipulating area, diversified manipulating functions, capability to integrate multiple manipulating functions in one device, compact and light device structure, etc. So far it has been utilizing the acoustic streaming eddies to trap, position, rotate, orientate and concentrate nanoscale entities. Proper acoustic streaming eddies are the key to implement and improve various nano manipulation functions. After proposing the ultrasonic methods for nano manipulations in recent years, the author's group has been researching the features of the acoustic streaming fields for various nano manipulations, and the effective methods to generate and control the acoustic streaming eddies. In this report, we demonstrate the features of the acoustic streaming eddies for the contact-type and noncontact-type nano trapping, nano rotary driving and nano concentration, and give the methods to generate and control the acoustic streaming eddies.

## **Invited Speech 6: Parametric Study on a Caisson Based OWC Wave Energy**

### **Converting System**

**Speaker:** Prof. Hsien-Hua Lee, National Sun Yat-sen University, China

**Time:** 11:30-12:10, Saturday Morning, October 22, 2016

**Location:** Kapok Room (木棉厅), 4th Floor, Guangdong Hotel (Shanghai)



### **Abstract**

This study uses a numerical method to analyze the proposed model structure. Before the parametric analysis, a pre-analysis to make sure the analytical results are accountable, a verification analysis was performed. The results

found are compared well with the limited experimental findings of Goda et al. and it is very encouraging to find that for the proposed method as an alternative for green energy developments, as long as an appropriate design is performed, an OWC combined with breakwater structure may provide an alternative for green energy system utilized in a harbor area. From the results of the first stage of parameter analysis that the size of the openings of the cell of converting system is variable, a traditional full opened cell is not necessary the most efficient design for the wave power conversion in terms of the variations of air pressure inside the cell and air speed through the outlet orifice that will drive the electricity power generator.

## Part III Technical Sessions

### Technical Session 1: Engineering and Technology I

Session Chair: Prof. Mihály Pituk, University of Pannonia, Hungary

Kapok Room (木棉厅), 4<sup>th</sup> Floor

14:00-18:00, Saturday Afternoon, October 22, 2016

Paper ID	Title	Author	Affiliation
80097	Current Trends in Competency Based Education	Ruben Morales-Menendez	Tecnologico de Monterrey
80090	XRD doping control of light-emitting cBN with a large size mismatch between the dopant and intrinsic atoms	Elena Shishonok	Belarussian State Technological University
80054	Hyperbolic Quaternion Reformulation of Maxwell-type Equations of Fluids	Suleyman Demir	Anadolu University
80057	Atomic vs. quantum dot open shell spectra	Jacob Katriel	Technion - Israel Institute of Technology
80040	Dynamic Programming to Identification Problems	Nina Subbotina	Krasovskii Institute of Mathematics and Mechanics
80092	Lyapunov Exponents of the Solutions of a Perturbed System of Ordinary and Delay Differential Equations	Mihály Pituk	University of Pannonia, Hungary
80093	On differentiability of solutions with respect to the delay function in functional differential equations	Ferenc Hartung	University of Pannonia
80099	Methodology for the Study of the Quality of CFRP Dry Drilling based on Macrogeometrical and Dimensional Deviations	Jorge Salguero	University of Cadiz
80100	Reverse Engineering based Methodology for Redesigning Contour Milling Tools	Ana Pilar Valerga Puerta	Universidad de Cádiz
80031	Theoretical and engineering approach to human power ornitopter design	Ilya Zverkov	Khristianovich Institute of Theoretical and Applied Mechanics

<b>16:00-16:15 Coffee Break</b>			
<b>80050</b>	Numerical Research on Flow Field of Water-jet Propeller at Different Speed	Wang Xuebao	Jiangsu University
<b>80018</b>	Analysis of the velocity non-uniformity in water jet inlet duct	Shen Zhanhao	Jingjiang Colledge of Jiangsu University
<b>80087</b>	Steep wave effects on a large-diameter vertical circular cylinder	Injun Yang	Inha University
<b>80088</b>	A study on the added resistance and wake distribution of a ship in waves using CFD	Jeongho Park	Inha University
<b>80089</b>	Development of a dynamic positioning system using adaptive acceleration feedback	Soonseok Song	Inha University
<b>80065</b>	Control of back-to-back inverters exciting electric generators of different types in parallel connection	Artur Bejger	Maritime University of Szczecin
<b>80046</b>	Structural Design Optimization of a Small Vertical-Axis Wind Turbine for Seismic Qualification and Lightweight	Choi Young Hyu	Dept. of Mech. Eng, Changwon National Univ., Changwon, Republic of Korea
<b>80052</b>	Characteristics of Mechanical and Electrical Power Transmission for Small-Scaled Wind Turbine	Kyujin Lee	Dept. of Mech. Eng, Changwon National Univ., Changwon, Republic of Korea
<b>80049</b>	Optimal Wind Farm Micro-Siting Models With Risk Benefit Analysis	Peng-Yeng Yin	National Chi Nan University



## Technical Session 2: Engineering and Technology II

Session Chair: TBD

Kapok Room (木棉厅), 4<sup>th</sup> Floor

08:30-12:00, Sunday Morning, October 23, 2016

Paper ID	Title	Author	Affiliation
80103	Mathematical approaches to the structural analysis and formalization of woven fabrics	Otabek Kasimov	Tashkent Institute of Textile and Light Industry
80060	The Multi-Service Center Decision Problem is NP-Complete for Split Graphs	Toshimitsu Anzai	Tohoku University
80086	Exact null-controllability of interconnected abstract evolution boundary control equations	Benzion Shklyar	Holon Institute of Technology, Israel
80075	Electrode Wear in Resistance Spot Welding of Zinc-Coated Steel Sheets	DHEERENDRA DWIVEDI	Indian Institute of Technology Roorkee
80071	Design Parametric Study for the Flow of R-407C inside a Capillary Tube	Ravi Kumar	Indian Institute of Technology Roorkee
80056	3D Software Technology, Applicable in Elab-oration of the Spatial Face Gear Drives for Incorporation into Robot Systems	Emiliya Abadzhieva	Akita University
80059	Development of an Ultrasonic Motor that Uses an Inchworm Shaped Deformation of a Metallic plate	Akihiro Naganawa	Akita University
<b>10:00-10:15 Coffee Break</b>			
80072	Research on the Product Derivation Method under the Interaction Design Thinking	Guangwei Liang	Beihang University
80096	Influence of Bed Temperature on Heat Shrinkage Shape Error in FDM Additive Manufacturing of the ABS-Engineering Plastic	Choi Young Hyu	Dept. of Mech. Eng., Changwon National University.
80076	Cerium Separation from Light Rare Earth Concentrate by Liquid-Liquid Extraction	Thiago Formiga	Centro de Desenvolvimento da Tecnologia Nuclear – CDTN, Brazil

<b>80077</b>	Study of Separation of Zirconium and Hafnium by Solvent Extraction Technique	Carlos Morais	Centro de Desenvolvimento da Tecnologia Nuclear – CDTN, Brazil
<b>80081</b>	Production of the modified liquid glass in the processing of kaolinitic clay	Sarsenbay Gulfiya	Institute of Metallurgy and Benefication, JSC, Science and Education Ministry of the Republic of Kazakhstan
<b>80022</b>	Cobalt Electrowinning Development for SX-EW Process	Jianming Lu	University of British Columbia
<b>80062</b>	Study of thermal and acoustic properties of casted metal-ceramic composite foams	Katarzyna Gawdzinska	Maritime University of Szczecin

## Part IV Abstracts

### Technical Session 1: Engineering and Technology I

**ID: 80097**

**Title: Current Trends in Competency Based Education**

**Name:** Ruben Morales-Menendez

**Affiliation:** Tecnológico de Monterrey

**Email:** rmm@itesm.mx

#### Abstract

The shortage of individuals with the abilities to perform a job position successfully demands innovative educational approaches. Competency Based Education (CBE) is a methodology that focuses on endowing students with the skills demanded by the industries and evaluates them regarding what they are able to do. A bank of competencies that students must acquire in a university academic program was discussed. Occupational trends as well as associated skills demands were detected. This research could be a source of practical knowledge for those organizations seeking to understand CBE foundations and for those wishing to initiate their path through this global educational trend.

**ID: 80090**

**Title: XRD doping control of light-emitting cBN with a large size mismatch between the dopant and intrinsic atoms**

**Name:** Elena Shishonok

**Affiliation:** Belarussian State Technological University

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#### Abstract

Cubic boron nitride (cBN) as the outstanding representative of the family of semiconducting wide bandgap nitrides and the closest analogue of diamond,

is produced and investigated. XRD method of doping control of cBN as doped with impurities of large atomic sizes, is suggested. The larger an atomic size mismatch between doping and intrinsic atoms of a semiconductor's crystal lattice the stronger its response through own strains and distortions. The distortions are expected to be notable in the case of the smallest intrinsic atoms of cBN and diamond. The data of XRD ( $\text{CuK}\alpha$ ) analysis of the light-emitting cBN in form of the cBN:RE single phase micropowders, doped with various rare-earth elements (RE) in different concentrations under high pressure conditions, are represented. The cBN:RE micropowders showed discrete photoluminescence spectra in IR-, red and green spectral ranges which are attributed to the intra-electronic transitions of  $\text{RE}^{3+}$  ions, located in cBN crystal lattice. The locations of the  $\text{RE}^{3+}$  ions in cBN crystal lattice are discussed. Extra-splits (as the additional ones to the  $\alpha_1$ - $\alpha_2$ -splits on  $\text{CuK}\alpha$ ) of basic peaks for cBN in XRD patterns of the cBN:RE, were discovered and analyzed using appropriate computer programs. As established, crystal lattice of cBN due to incorporation of  $\text{RE}^{3+}$  ions in dependence on the ions' size and their concentrations in cBN, is non-uniformly and controllably distorted. Results of the present work can be useful to manufacture cBN with predictable functional properties, as well as for in situ doping control of cBN and diamond.

**ID: 80054**

**Title: Hyperbolic Quaternion Reformulation of Maxwell-type Equations of Fluids**

**Name:** Suleyman Demir

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**Abstract**

The hyperbolic quaternions are 4-dimensional and non-associative mathematical structures. In this paper, after a brief summary about algebra of the hyperbolic quaternions, a new model is proposed for the reformulation of Maxwell-type equations of compressible fluids. The relevant field equations are presented by this type of quaternions. These equations are given in a compact, simple and elegant way. Moreover, the fluid wave equation is expressed in similar form to electromagnetic and gravitational counterparts. Derived equations are compared with their vectorial, biquaternionic, and octonionic representations.

**ID: 80057**

**Title: Atomic vs. quantum dot open shell spectra**

**Name:** Jacob Katriel

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**Abstract**

Multi-electron quantum dots are frequently discussed as analogues of atomic systems. We compare the dependence of the energy level splitting on the strength of the one-body attractive potential in these two families of systems. For an atomic system,

$$\mathcal{H} = -\frac{1}{2} \sum_{i=1}^N \nabla_i^2 - \sum_{i=1}^N \frac{Z}{r_i} + \sum_{i<j}^N \frac{1}{r_{ij}},$$

combination of the Hellmann-Feynman and the virial theorem yields

$$L = Z \frac{dE}{dZ} \text{ and } C = -Z^3 \frac{d}{dZ} \left( \frac{E}{Z^2} \right), \text{ where } E, L \text{ and } C$$

are the total energy and the contributions of the nuclear attraction and the inter-electronic repulsion, respectively.

For a confining quantum dot we write the Hamiltonian in the form

$$\mathcal{H} = -\frac{1}{2} \sum_{i=1}^N \nabla_i^2 + \sum_{i=1}^N \left( \frac{r_i}{R} \right)^k + \sum_{i<j}^N \frac{1}{r_{ij}},$$

that allows a convenient interpolation between the harmonic ( $k = 2$ ) and the infinite spherical well ( $k \rightarrow \infty$ ). Here, a combination of the Hellman-Feynman and the virial theorem

$$\text{yields } H = -\frac{1}{k} R \frac{dE}{dR} \text{ and}$$

$$C = \frac{k+2}{k} R^{\frac{2-k}{2+k}} \frac{d}{dR} \left( R^{\frac{2k}{k+2}} E \right), \text{ where } H \text{ is the}$$

contribution of the one body attraction. We note in passing that the atomic case is obtained as a special case by setting  $k = -1$  and  $R = -Z$ . In the

$$\text{harmonic case } H = -\frac{1}{2} R \frac{dE}{dR} \text{ and } C = 2 \frac{d}{dR} (RE),$$

$$\text{and } R = \frac{\sqrt{2}}{\omega}, \text{ where } \omega \text{ is the oscillator frequency.}$$

For the infinite spherical well  $H = 0$  and

$$C = \frac{1}{R} \frac{d}{dR} (R^2 E), \text{ where } R \text{ is the well radius.}$$

Application of these relations indicates an inevitable reversal of the difference of the inter-electronic repulsions as a function of  $R$ , in related pairs of states in atomic systems, that are degenerate in the absence of inter-electronic repulsion (such as different multiplicity states corresponding to a common configuration). This is a consequence of the

$$\text{fact that in such related pairs of states the ratio } \frac{\Delta E}{Z^2},$$

where  $\Delta E$  is the corresponding energy difference,

vanishes at both  $Z \rightarrow \infty$  and  $Z = Z_c$ , where

$Z_c > 0$  is some critical charge ( $Z_c \leq N - 1$ ).

Actually,  $\lim_{Z \rightarrow \infty} \frac{\Delta C}{\Delta L} = 1$  and  $\lim_{Z \rightarrow Z_c} \frac{\Delta C}{\Delta L} = -1$ .

Such a reversal does not take place in confined quantum dots. In the high confinement (weak perturbation) limit ( $R \rightarrow 0$ ) first order perturbation

theory yields  $\lim_{R \rightarrow \infty} \frac{\Delta C}{\Delta H} = k + 2$ . In the strong

perturbation limit ( $R \rightarrow \infty$ ) we assume that

$\Delta E \sim \alpha R^{-\nu}$ , hence  $\frac{\Delta C}{\Delta H} \sim k \left( \frac{2}{\nu} - 1 \right) - 2$ . Numerical

evidence for the harmonic  $^{1,3}P$  pair ( $k = 2$ )

suggests that  $\nu \sim \frac{2}{3}$ , so  $\frac{\Delta C}{\Delta H} \sim 2$ .

**ID: 80040**

**Title: Dynamic Programming to Identification Problems**

**Name:** Nina Subbotina

**Affiliation:** Krasovskii Institute of Mathematics and Mechanics

**Email:** subb@uran.ru

**Abstract**

An identification problem is considered as inaccurate measurements of dynamics on a time interval are given. The model has the form of ordinary differential equations which are linear with respect to unknown parameters. A new approach is presented to solve the identification problem in the framework of the optimal control theory. A numerical algorithm based on the dynamic programming method is suggested to identify the unknown parameters. Results of simulations are exposed.

**ID: 80092**

**Title: Lyapunov Exponents of the Solutions of a Perturbed System of Ordinary and Delay Differential Equations**

**Name:** Mihály Pituk

**Affiliation:** University of Pannonia, Hungary

**Email:** pitukm@almos.uni-pannon.hu

**Abstract**

In this talk we will consider a perturbation of a linear system of ordinary and delay differential equations. The main result shows that if the Lyapunov exponent of a solution is finite, then it is equal to the real part of one of the eigenvalues of the unperturbed linear part of the system. If in addition the solution is positive then its Lyapunov exponent is necessarily a (real) eigenvalue of the linear part.

**ID: 80093**

**Title: On differentiability of solutions with respect to the delay function in functional differential equations**

**Name:** Ferenc Hartung

**Affiliation:** University of Pannonia

**Email:** hartung.ferenc@uni-pannon.hu

**Abstract**

In this talk we consider a class of nonlinear functional differential equations with time-dependent delay. We discuss continuous differentiability of the solution with respect to the time delay function for each fixed time value assuming natural conditions on the delay function. As an application of the differentiability result, we give a numerical study to estimate the time delay function using the quasilinearization method.

**ID: 80099**

**Title: Methodology for the Study of the Quality of CFRP Dry Drilling based on Macrogeometrical and Dimensional Deviations**

**Name:** Jorge Salguero

**Affiliation:** University of Cadiz

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### **Abstract**

Commonly, Carbon Fiber Reinforced Plastics (CFRP) aerospace elements need to be machined (drilling) for subsequent assembly operations, mainly riveting, taking a critical importance the quality requirements of the holes. Some of the adjustment defects that can be produced during the dry drilling of CFRP are related to macrogeometrical (diameter, D, and cylindricity, DC) deviations.

This paper reports on the results of a study of the influence of the cutting parameters V (cutting speed) and f (feedrate) on the D and DC deviations in the dry drilling of CFRP. A particular procedure based on plastic hole replicas has been performed. Diameters deviations were acceptable in all the cases studied. Because of this, DC is the controlling factor for accepting the drilled holes. In the studied range, lowest cutting speeds and highest feedrates have allowed obtaining the minimum cylindricity deviation.

**ID: 80100**

**Title: Reverse Engineering based Methodology for Redesigning Contour Milling Tools**

**Name:** Ana Pilar Valerga Puerta

**Affiliation:** Universidad de Cádiz

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### **Abstract**

Reverse Engineering (RE) involves the use of techniques aimed to retrieve information about manufactured products, not only regarding geometries, but also materials and functionality. Today, even if several RE techniques are known, many of them still leave the object unusable to analyze. Nevertheless, other alternatives to this problem allows for obtaining a Digital or Virtual Model (VM) via the three-dimensional scanning. Getting the VM of an item, via scanning or not, can offer many possibilities to digital analysis (FEM). Furthermore, starting from VM, it is possible to

achieve the physical reproduction of an element, part or workpiece -in the same or different materials- using Additive Manufacturing (AM) technologies. This enables to improve the product through a redesign process.

In this paper, a RE based methodology is proposed for redesigning a tool for contour milling, after comparing different microscopy based techniques, 3D-Scanner tools and CAD-CAGD utilities for generating a Virtual Model of the newly designed mill.

**ID: 80031**

**Title: Theoretical and engineering approach to human power ornithopter design**

**Name:** Ilya Zverkov

**Affiliation:** Khristianovich Institute of Theoretical and Applied Mechanics

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### **Abstract**

The article considers the issues on preliminary calculation of human-powered ornithopter general performances. The model of “simple ornithopter” is introduced. Giving an example of simple ornithopter interaction with the environment, the formula of relation of ornithopter theoretically available propulsion to kinematic and physical parameters of its horizontal flight parameters is derived. The tasking is performed for the following stages of calculation and design of the human-powered ornithopter.

**ID: 80050**

**Title: Numerical Research on Flow Field of Water-jet Propeller at Different Speed**

**Name:** Wang Xuebao

**Affiliation:** Jiangsu University

**Email:** xuebao9212@163.com

### **Abstract**

The full flow passage numerical simulation of a

contra-rotating axial water-jet propeller was performed at different speed based on CFD method. Using SST turbulent model, streamlines were obtained. Velocity characteristics at suction duct cross-sections were carefully observed for further analysis. Simulation results indicate that flow field in water-jet propeller particularly in suction pipe and front impeller is greatly affected by vehicle speed. Velocity and pressure change obviously at different speed. With the increase of speed, the flow rate of the water jet propeller increases and flow turns more complex, the lower part of the front impeller has maximum speed. Inlet velocity is always lower than cruising speed because of the hull's boundary layer. Flow changed more fiercely in suction pipe compared to those in other parts. Flow separation occur in suction duct and a vortex is observed at upper half. Close to the axis, small vortices generated at the upper part of the shaft.

**ID: 80018**

**Title: Analysis of the velocity non-uniformity in water jet inlet duct**

**Name:** Shen Zhanhao

**Affiliation:** Jingjiang Colledge of Jiangsu University

**Email:** shenzhspar@126.com

#### **Abstract**

Since the pump waterjets unique advantages, it's applied more widely. But the Inlet duct and other structures prone to particular flows. Since the inlet duct of a special structure, the velocity distribution shows non-uniformity, departing from the waterjet pump design scenarios. In this paper, waterjet pump is simulated to study its velocity non-uniform of inlet duct and to investigate the discipline of the velocity distribution. By changing the inlet boundary conditions, the corresponding velocity field is obtained, to analyze the results under different conditions. It is researched the effect of inlet duct velocity non-uniformity on water jet propulsion system.

**ID: 80087**

**Title: Steep wave effects on a large-diameter vertical circular cylinder**

**Name:** Injun Yang<sup>1\*</sup>, Tahsin Tezdogan<sup>2</sup>, Young-Gill Lee<sup>3</sup>

**Affiliation:** <sup>1</sup>Dept. of Naval Architecture and Ocean Engineering, Graduate School, Inha University, Incheon, South Korea

<sup>2</sup>Dept. of Naval Architecture and Oceanand Marine Engineering, University of Strathclyde, Glasgow, UK

<sup>3</sup>Dept. of Naval Architecture and Ocean Engineering, Inha University, Incheon, South Korea

**Email:** kokuki8@gmail.com

#### **Abstract**

The objective of this paper is to suggest modified coefficients for estimating horizontal forces on a cylinder of large diameter in steep waves using Computational Fluid Dy-namics (CFD). For those who are interested in estimating wave forces, the use of CFD as described in this paper can reduce required analysis times, providing predicted wave force values which may be useful for early stage designing. A comparison of fully- nonlinear numerical results with the Morison equation and Faltisen Newman Vinje model developed by Faltisen et al. (1995) is conducted to yield each correct co-efficient, respectively. The modified Morison equation and FNV model show good agreement with the CFD results.

**ID: 80088**

**Title: A study on the added resistance and wake distribu-tion of a ship in waves using CFD**

**Name:** Jeong-Ho Park, Young-Gill Lee, In-Jun yang, Ui-Ha Kang

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#### **Abstract**

While increasing interest in eco-friendly International, the IMO (International Maritime Organization, IMO) has introduced EEDI(Energy Efficiency Design Index) to regulate greenhouse gas emissions of the ship from 2013. For this reason, efficiency of the vessel operation has become a major concern of shipbuilding and shipping industry. As a study on the efficiency of a ship, reducing of added resistance in waves by decreasing the reflected wave of bow has been activated. Improving the bow shape at the short-wavelength region has been primary study of added resistance. In this study, the added resistance variation according to the change of bow shape is estimated from short-wavelength region to long one. In addition, the possibility of operating performance improvement is examined by studying of the wake distribution on CFD and KVLCC2 without rudder and propeller is conjugated.

**ID: 80089**

**Title: Development of a dynamic positioning system using adaptive acceleration feedback**

**Name:** Soonseok Song<sup>1</sup>, Longbin Tao<sup>2</sup>, Sanghyun Kim<sup>1</sup>

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<sup>2</sup> School of Marine Science and Technology, Newcastle University, Newcastle upon Tyne, United Kingdom

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**Abstract**

The significant of the Dynamic Positioning (DP) system has increased with the growing number of offshore activities. A study on an adaptive acceleration controller has been conducted. In conjunction with a proportional–integral–derivative controller (PID controller), the newly developed DP system uses acceleration feedback which varies in accordance with a condition. To evaluate the station-keeping performance of the proposed DP system, time-domain simulations of a dynamically

positioned vessel under environmental disturbances of current, wind, and wave loads have been carried out with the use of a DP simulator developed previously. The simulation results showed an improved station-keeping performance with regards to standard deviation and maximum values of horizontal and heading error compared to a conventional PID controller and normal acceleration feedback controller.

**ID: 80065**

**Title: Control of back-to-back inverters exciting electric generators of different types in parallel connection**

**Name:** Artur Bejger

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**Abstract**

The paper covers theoretical background and chosen experimental results for inverters working in synchronous parallel connection with two different types of electrical generators. Synchronous and asynchronous generator inverters are in back-to-back connection. Digital signal processor DSP and field-programmable gate array FPGA provide excitation of machines and maintain appropriate level of DC link voltage. Asynchronous generator is VSI driven with use of sensorless algorithm based on field oriented control machine model with discretized machine state observer, while FOC controlled inverter excites synchronous generator. Proper control of line side inverters allows smooth distribution of active and reactive power on AC side. Line side inverters can be synchronized with ship's electrical network by means of software phase locked loop PLL.

**ID: 80046**

**Title: Structural Design Optimization of a Small Vertical-Axis Wind Turbine for Seismic Qualification and Lightweight**



**Name:** Choi Young Hyu

**Affiliation:** Dept. of Mech. Eng, Changwon National Univ., Changwon, Republic of Korea

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#### **Abstract**

Recently, there is a growing interest in seismic qualification of ridges, buildings and mechanical equipment worldwide due to increase in accident caused by earthquake, it causes a problem in electric energy supply. Therefore, this study performed structural design optimization using a Genetic Algorithm(GA) for improving seismic qualification and lightening of a small vertical axis wind turbine. The design problem is to find thickness of each part of structure to minimize seismic acceleration gain and structure weight of the wind turbine. When the Required Response Spectrum(RRS) was entered, the maximum stress, maximum deformation, seismic acceleration gain and condition of resonance avoidance were selected as design constraints. Also, structural optimization was conducted by changing initial design variables to confirm robustness of the structural optimization results and it was observed if the structural optimization results showed good agreement. In relation to structural optimization using a GA, this study succeeded in structural optimization of a small vertical-axis wind turbine, which satisfied design constraints, had seismic qualification and was light in weight.

**ID: 80052**

**Title: Characteristics of Mechanical and Electrical Power Transmission for Small-Scaled Wind Turbine**

**Name:** Kyujin Lee

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#### **Abstract**

Small-scaled wind turbine is converted to

mechanical power of windmill to electric power by generator. However almost all studies seems to have overlooked converting relation of mechanical & electric power. It the reason for was very difficult establishing wind turbine system. In this paper, it is define equation of converting relation of mechanical & electric power. And it is verified by experimental methods. Defined equation will be used in developing electric devices such as inverter and controller in wind turbines. In addition this method can be used in the fields that utilize the rotational power into electrical power through generator.

**ID: 80049**

**Title: Optimal Wind Farm Micro-Siting Models With Risk Benefit Analysis**

**Name:** Peng-Yeng Yin

**Affiliation:** National Chi Nan University

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#### **Abstract**

The over-usage of fossil fuels has brought drastic climate changes and environmental damages to the world. The awareness of this development has gathered over 196 countries in Paris to put forward a protocol for restraining the emission of greenhouse gases. This commitment relies on an anticipation of a future rapid growth in renewable energy capacity. In the last few years, the wind energy production was growing about 30% annually worldwide. As of 2014, wind energy generation exceeded 4% of global electricity demand. The classic Mosetti's wind farm micro-siting model aims to minimize the cost of energy (COE) considering the wake effect. However, the risk of the energy generation under the wind uncertainty has seldom been contemplated. This paper propose risk benefit analysis based approaches to deal with the variations of wind conditions while still keeping the COE as effective as that obtained by the classic Mosetti's model. The feasibility of our model is validated through comparative performance, convergence analysis, and worst-case analysis.

## Technical Session 2: Engineering and Technology II

**ID: 80103**

**Title: Mathematical approaches to the structural analysis and formalization of woven fabrics**

**Name:** Otabek Kasimov

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### Abstract

The present paper shows the mathematical approach of formalization of textile fabrics, based on concepts and elements of graph theory and the structural analysis of woven structures.

**ID: 80060**

**Title: The Multi-Service Center Decision Problem is NP-Complete for Split Graphs**

**Name:** Xiao Zhou

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### Abstract

We deal with the problem of locating facilities in an undirected graph  $G$ . Each of given  $p$  facilities is located on a vertex or edge of  $G$ , and provides distinct service required by all vertices. For each vertex  $v$  of  $G$ , the  $p$ -service distance of  $v$  is the summation of its shortest distances from  $v$  to the  $p$  facilities. The  $p$ -service center problem is to find locations of the  $p$  facilities in  $G$  to minimize the maximum value of  $p$ -service distances among all vertices. It is known that the problem is NP-hard for general graphs. In this paper we consider the decision version of the problem which asks whether there is a placement of the  $p$  facilities in  $G$  such that the  $p$ -service distance of each vertex in  $G$  is at most a given positive real number. In this paper we show that the  $p$ -service center decision problem is NP-complete

even for split graphs with unweighted edges, and hence the  $p$ -service center problem is NP-hard even for split graphs.

**ID: 80086**

**Title: Exact null-controllability of interconnected abstract evolution boundary control equations**

**Name:** Benzion Shklyar

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### Abstract

The paper deals with exact null-controllability problem for a linear control system, consisting of two serially connected abstract controls systems with unbounded input operators, where the first control system is governed by a control of the second one. Controllability conditions are obtained. Applications to the exact null-controllability for interconnected control system of the heat and delay differential equations are considered.

**ID: 80075**

**Title: Electrode Wear in Resistance Spot Welding of Zinc-Coated Steel Sheets**

**Name:** DHEERENDRA DWIVEDI

**Affiliation:** Indian Institute of Technology Roorkee

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### Abstract

This paper presents a study on wear behaviour of copper electrodes used in resistance spot welding (RSW) of zinc-coated steel sheets. To study this, a 0.6 mm thick zinc-coated steel sheet was spot welded using suitable combination of spot welding parameters and then electrode tip diameter, length of electrode and mass of electrode were measured after regular number of spot welds. Carbon imprint

method was used to get electrode face diameters and contact conditions at different weld numbers. It was observed that electrode wear increases with an increasing number of spot welds for zinc-coated steel which is indicated by increased weight loss of the copper electrode, reduction in the electrode length, and enlargement of the electrode tip diameter. Lower electrode undergoes higher wear than upper electrode. Increase in the number of spot welds also showed increased contamination of the electrode. Pit formation was found to be associated with removal of alloy products from the electrode surface.

**ID: 80071**

**Title: Design Parametric Study for the Flow of R-407C inside a Capillary Tube**

**Name:** Ravi Kumar

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#### **Abstract**

An experimental investigation was carried out to observe the effect of sub-cooling degree on mass flow rate of R-407C through the adiabatic straight capillary tubes. The variation of mass flow rate with the sub-cooling degree is observed to be independent of capillary length for a given capillary diameter and capillary inlet pressure with an error band of  $\pm 1.5\%$ . An average rise in refrigerant mass flow rate of 8.8, 14.3 and 16.5 percent was observed for capillary tube diameters of 1.02 mm, 1.27 mm and 1.52 mm respectively with an increase of sub-cooling from 5 °C to 10 °C.

**ID: 80056**

**Title: 3D Software Technology, Applicable in Elaboration of the Spatial Face Gear Drives for Incorporation into Robot Systems**

**Name:** Emiliya Abadzhieva

**Affiliation:** Akita University

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#### **Abstract**

The study treats a specific technological approach for the elaboration of small manufacturing series of highly precise hyperboloid gears with small module of the teeth and with not big dimensions of the gear mechanism. It is based on the application of the elaborated by authors mathematical models, algorithms and computer programs for synthesis upon a pitch contact point and upon a mesh region. A special feature of the established approach is the application of 3D software prototyping and 3D printing of the designed transmissions. The presented here models of the transmissions with crossed axes and face mated gears are intended for implementation into the driving of two type robots: bio-robot hand and walking robot with four insect-type legs.

**ID: 80059**

**Title: Development of an Ultrasonic Motor that Uses an Inchworm Shaped Deformation of a Metallic plate**

**Name:** Akihiro Naganawa

**Affiliation:** Akita University

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#### **Abstract**

At the present time, ultrasonic motors have been developed for a variety of purposes such as linear motion drives and rotational drives. The elaboration of an ultrasonic motor is time-consuming, because it is developed adapting on its application. In this study, a new ultrasonic motor structure that combines a piezoelectric element and a metallic plate is elaborated. The driving principle of this motor is that the metal plate is bent to an inchworm shape and rotates the rotor when the piezoelectric element is stretched. The objective of this study is to verify the functioning of the new motor experimentally.

**ID: 80072**

**Title: Research on the Product Derivation Method under the Interaction Design Thinking**

**Name:** Guangwei Liang  
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**Abstract**

Explore the new way of product derivation by integrating the interaction design thinking into the product derivation method. It analyzes the thinking mode of interaction design, describes how to make the product provide better experience for the user, from the perspective of the four elements of people, activity, context and technology, and shows how to combine interaction thinking for product derivation through the cases. Good products in addition to the realization of the function also need to meet the needs of the user experience. Product derived can get new methods and ideas from the interaction design of systematic thinking, so that products can provide better service for users in the digital era.

**ID: 80096**

**Title: Influence of Bed Temperature on Heat Shrinkage Shape Error in FDM Additive Manufacturing of the ABS-Engineering Plastic**

**Name:** Choi Young Hyu  
**Affiliation:** Dept. of Mech. Eng., Changwon National University.  
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**Abstract**

In case of manufacturing hexahedral ABS (Acrylonitrile Butadiene Styrene) plastic components using a FDM (Fused Deposition Modeling) – based 3D printer, undesirable shape errors occur in the product due to heat shrinkage. This paper experimentally observed the influence of the bed temperature change on the deformed shape errors of a hexahedral specimen of 100×50×50 mm<sup>3</sup> produced by using a 3D printer. During printing work, the head nozzle temperature was kept at 240°C and the head speed was set at 50 mm/s. The chamber was enclosed with a PC-plate. 3D printing was conducted at four different bed temperatures; 50, 70, 90, and

110°C. After the produced specimens naturally cooled down to room temperature, their de-formed shape errors were measured. As a result, the higher the bed temperature, the lower the deformed shape errors of the specimens were. However, if the bed temperature had exceeded 120°C, laminating ad-hesion became poor. That seems to occur because of the material phase change and can make 3D printing work very hard as a consequence. Results of this study can be helpful to set optimum bed temperature condition in FDM additive manufacturing.

**ID: 80076**

**Title: Cerium Separation from Light Rare Earth Concentrate by Liquid-Liquid Extraction**

**Name:** Thiago Formiga  
**Affiliation:** Centro de Desenvolvimento da Tecnologia Nuclear – CDTN, Belo Horizonte, Brazil  
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**Abstract**

This work presents an investigation of solvent extraction parameters in order to obtain high purity cerium from a mixture containing other rare earths elements, as an alternative to oxidation and selective precipitation or dissolution. The study was carried out using a sample of sulfuric liquor obtained from the leaching of monazite rich in light rare earth elements, also referred as REE, (La, Ce, Pr, Nd) provided by INB (Nuclear Industries of Brazil). Experiments were carried out in chloridric, nitric and sulfuric media. The nitric and chloridric solutions were prepared by precipitation of the REE from the sulfuric liquor as rare earths oxalate, calcining the precipitate and dissolving it with nitric or hydrochloridric acid. The separation of cerium was investigated in its trivalent and tetravalent forms. The parameters investigated were: type and concentration of extractant, type and amount of the oxidizing agent, liquor acidity, and volumetric ratio between organic and aqueous phases. The preference of the organic phase to extract cerium in its oxidized form (IV) over

the other rare earths elements was confirmed, allowing the obtainment of a high purity cerium solution. The

best results were achieved in nitric medium, with cerium in its tetravalent form, using cationic extractants (P507 or D2EHPA) and a mixture of potassium persulfate and silver chloride as oxidizing agents, yielding over 99% of cerium extraction with over 99% of purity.

**ID: 80077**

**Title: Study of Separation of Zirconium and Hafnium by Solvent Extraction Technique**

**Name:** Carlos Morais

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**Abstract**

This paper describes the study of the extraction of Zr and Hf in nitric and hydrochloric media by solvent extraction technique using different types of extractants. The effect of the extractants DEHPA, IONQUEST<sup>®</sup>801 and CYANEX<sup>®</sup>272, TBP, CYANEX<sup>®</sup>923, PRIMENE<sup>®</sup>JTM, ALAMINE<sup>®</sup>336 and ALIQUAT<sup>®</sup>336 was investigated. For acid extractants in both nitric and hydrochloric media, a high degree of extraction was observed, although they had low selectivity in separating the metals. For the acid extractants also, it was not possible to strip the metals from the organic phase through acid solutions. In this case, a stripping solution with very high acidity would be required, and this is not viable. When the basic extractants were used, no metal extraction was observed under the conditions investigated, indicating no extractable anionic species in either media. The optimum zirconium/hafnium separation was achieved using an acidity of 7.0 mol L<sup>-1</sup>, nitrate concentration of 9.2 mol L<sup>-1</sup> and 1.5 mol L<sup>-1</sup> of TBP. In these conditions, a separation factor of 12.6 was obtained.

**ID: 80081**

**Title: Production of the modified liquid glass in the processing of kaolinitic clay**

**Name:** Sarsenbay Gulfiya

**Affiliation:** Institute of Metallurgy and Benefication, JSC, Science and Education Ministry of the Republic of Kazakhstan, Almaty, Kazakhstan

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**Abstract**

Production of modified liquid glass and quartz materials from kaolinite clay of Alekseev deposit of Kazakhstan was studied. The sodium liquid glass processed by kaolinite clay, with chemical composition (g/dm<sup>3</sup>): SiO<sub>2</sub> - 350; Na<sub>2</sub>O - 155; Al<sub>2</sub>O<sub>3</sub> - 2,1; Fe<sub>2</sub>O<sub>3</sub> - 0,3, silicate module - 2.33 and density - 1.49 g / cm<sup>3</sup> has been used. The sodium liquid glass complies with the Russian Interstate standard 13078-81 for sodium liquid glass. 10 samples of modified liquid glass were synthesized by introducing modifiers in an amount of 4% by weight of the solution into the liquid glass. Hard quartz material produced by using synthesized modified liquid glass was obtained. It has been established that the obtained modified liquid glass from kaolinite clay can improve the strength of the quartz material for 1.6 - 3.12 times higher than the initial liquid glass. Using liquid glass modifier to the inorganic sodium nitrate (NaNO<sub>3</sub>) increases the strength 3.12 times.

**ID: 80022**

**Title: Cobalt Electrowinning Development for SX-EW Process**

**Name:** Jianming Lu

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**Abstract**

The process of Minera y Metalúrgica del Boleo recovers cobalt from a complex oxide and sulfide ore by solvent extraction and electrowinning after the recovery of copper and zinc (as copper cathode and zinc sulfate monohydrate). As part of the process

development, cobalt electrowinning was systematically studied with respect to temperature, pH, pitting behaviour, deposit morphology, deposition stress and interfacial tension. Cobalt was deposited on a coated stainless steel mandrel cathode with exposed circles to allow plating of disk shaped deposits over the surface of the cathode which could be easily stripped after 5-7 days of deposition. A small individual area also prevents the detachment of a cobalt deposit from a cathode due to a high deposition stress. The morphology and pitting behaviour varied for different commercial cobalt raw materials used for making cobalt sulfate solution as they contained different impurities. In the temperature range from 50 to 65C, a higher temperature results in a brighter deposit with more pits and smaller lateral dendrites. The cobalt deposition current efficiency was around 98% at pH 3.0 and was not sensitive to temperature. With decreasing pH from 3.5 to 2.0, the cobalt current efficiency decreased from 99 to 88% and the growth of lateral dendrites were significantly suppressed. The formation of pits resulted from the adhesion of hydrogen bubbles on the cobalt deposit. The adhesion of hydrogen bubbles was determined by the prevailing surface and interfacial tensions. Anti-pitting agents were used to change the interfacial and surface tensions in such a way that the detachment of bubbles were facilitated, resulting in a

pit-free cobalt deposit. The anti-pitting agents affected the deposit morphology and internal stress. The impact of the anti-pitting agents on the disengagement of organic and aqueous phases during cobalt solvent extraction was also investigated. A pilot plant was built to successful verify the production of high quality electrolytic cobalt. Now Boleo cobalt electrowining plant has started the production.

**ID: 80062**

**Title: Study of thermal and acoustic properties of casted metal-ceramic composite foams**

**Name:** Katarzyna Gawdzinska

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**Abstract**

Because of its features metallic foams can be used as good insulation material. Thermal and acoustic properties of casted metal-ceramic composite foams find their place in transportation objects and can act as fire resistant and acoustic bulkhead insulator. There are presented acoustic and thermal capabilities of proposed composite foams (AlSi11/SiC). Composite foam was prepared by the gas injection method, consisting in direct injection of gas into liquid metal.

# **Part V Instructions for Presentations**

## **Oral Presentation**

### **Devices Provided by the Conference Organizing Committee:**

- Laptops (with MS-office & Adobe Reader)
- Projectors & Screen
- Laser Sticks

### **Materials Provided by the Presenters:**

- PowerPoint or PDF files

### **Duration of each Presentation:**

- Regular Oral Session: 10-15 Minutes of Presentation
- Plenary Speech: 30 Minutes of Presentation

## Part VI Hotel Information

### About Hotel

Guangdong Hotel (Shanghai) is located on Yi Xian Road, DaBaiShu industry & trading center in Shanghai, adjacent to the prestigious universities, such as Fudan, Tongji and Shanghai international studies university. DaBaiShu area is one of the 12 commercial zones in Shanghai, where conveniently linked by track line 3 and inner elevated ring road. Its 15 minutes ride to the Bund and Downtown area.

**Address:** 328 Yixian Road, Hongkou District, Shanghai

**Contact Number:** 86-21-55589888

**Fax Number:** 86-21-55512808

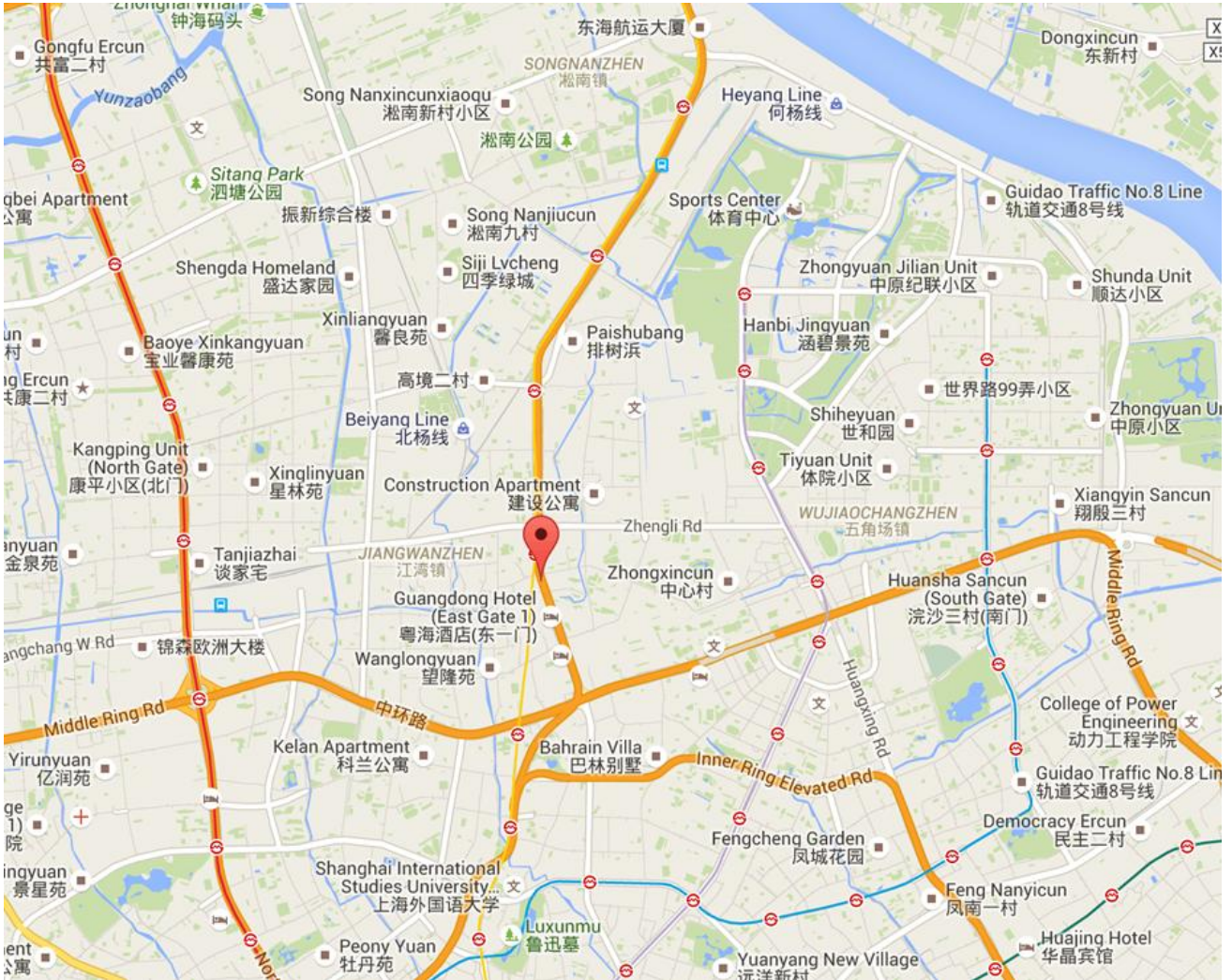
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