



ICAT 2021

**PROCEEDING:
INTERNATIONAL CONFERENCE ON
APPLIED THERMOFLUIDS &
COMPUTATIONAL FLUIDS MECHANICS
(ICAT 2021)**

**Proceeding:
International Conference on Applied Thermofluids &
Computational Fluids Mechanics
(ICAT 2021)**



ICAT 2021

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Mechanics (ICAT 2021)**

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Contents

1. A SHORT REVIEW OF THE VOID AND MOISTURE CONTENT ANALYSIS VIA EXPERIMENTAL AND THEORETICAL WORKS OF SYNTHETIC AND NATURAL FIBER REINFORCED COMPOSITES	1
2. A SHORT REVIEW OF THE PERMEABILITY APPROACHES VIA EXPERIMENTAL AND MODELLING WORKS OF FIBRE REINFORCED COMPOSITES AND THE FACTORS AFFECT PERMEABILITY OF BEHAVIOUR DURING IMPREGNATION PROCESS.....	2
3. A SHORT REVIEW OF THE RHEOLOGICAL STUDIES OF EXPERIMENTAL AND MODELLING WORKS OF FIBER REINFORCED COMPOSITES AND THE FACTORS AFFECT RHEOLOGICAL BEHAVIOUR DURING IMPREGNATION PROCESS.....	3
4. A REVIEW OF INTERNAL RESISTANCE AND TEMPERATURE RELATIONSHIP, STATE OF HEALTH AND THERMAL RUNAWAY FOR LITHIUM-ION BATTERY BEYOND NORMAL OPERATING CONDITION.....	4
5. PENG-ROBINSON CUBIC EQUATION OF STATE BASED ON KEY GROUP CONTRIBUTION AND CALCULATION OF NITROGEN GAS SOLUBILITY IN MMA DIMER.....	5
6. MODELLING AND VALIDATING THE SPRAY CHARACTERISTICS OF A CO-AXIAL TWIN-FLUID ATOMIZER USING OPENFOAM	6
7. THE PERFORMANCE OF CALCIUM CHLORIDE AND SILICA GEL AS SOLID DESICCANT DEHUMIDIFIER FOR INDOOR AIR QUALITY	7
8. SIMULATION OF EPOXY RESIN FLOW ON RADOME MOULD USING WOVEN FLAX FIBRE AND GLASS FIBRE WITH VACUUM INFUSION PROCESS	8
9. INVESTIGATION OF THE PHYSICAL PROPERTIES ON THE BIODIESEL SAMPLES.....	9
10. NUMERICAL INVESTIGATION OF HEAT TRANSFER INSIDE PARTICIPATING MEDIA: BUILT THERMAL ENVIRONMENT APPLICATION	10

A SHORT REVIEW OF THE VOID AND MOISTURE CONTENT ANALYSIS VIA EXPERIMENTAL AND THEORETICAL WORKS OF SYNTHETIC AND NATURAL FIBER REINFORCED COMPOSITES

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Abstract: *In this paper, a short review on the void and moisture content studies of fiber reinforced composites for both, synthetic and natural based fibers are presented. The review summarized the research papers in which include experimental and theoretical works that related to the void and moisture content studies. In addition to that, this review paper highlighting a few research studies conducted in literature on the effects of the void and moisture on the mechanical performances of the composite. Few common measurement methods used for the void and moisture determination are discussed here. The aims of this short review, mainly to capture the trend ranging from the recent five years back and summarize the various studies and also to compare and conclude the most common method for the determination of the void and moisture content. This paper is mainly providing a baseline in the selection of the methods for the future work of the author's work with regard to the reduction of the presence of voids and moisture occur during the impregnation process of fiber reinforced composites, especially when using natural-based fiber.*

Keywords: *Void; moisture content; natural fibre composites)*

A SHORT REVIEW OF THE PERMEABILITY APPROACHES VIA EXPERIMENTAL AND MODELLING WORKS OF FIBRE REINFORCED COMPOSITES AND THE FACTORS AFFECT PERMEABILITY OF BEHAVIOUR DURING IMPREGNATION PROCESS

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Abstract: *In this paper, a short review on the permeability studies of fibre reinforced composites for both, synthetic and natural based fibres, respectively, are presented. The review summarized the research papers, which focus in the experimental, theoretical and/or modelling works that related to the permeability studies. In addition to that, this review paper highlighting a few research studies conducted in literature on the main factor affecting the permeability behaviour and lead to effect the performances of the composite. The aims of this short review, mainly to capture the trend ranging from the recent five years back and summarize the various studies carried out whether via experimental, theoretical or modelling works in providing a baseline study for the selection of the appropriate methods for the permeability determination of woven fabric during the impregnation process of pre-preg in the author's work.*

Keywords: *Permeability; pre-impregnation; fabric composites*

A SHORT REVIEW OF THE RHEOLOGICAL STUDIES OF EXPERIMENTAL AND MODELLING WORKS OF FIBER REINFORCED COMPOSITES AND THE FACTORS AFFECT RHEOLOGICAL BEHAVIOUR DURING IMPREGNATION PROCESS

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Abstract: *Rheological behaviour is an important factor affecting the flow behaviour of a fluid and many aspects related to this, mainly in the manufacturing process of fiber reinforced composites, either for Newtonian fluids or non-Newtonians fluids. During impregnation process, the viscosity changes with temperatures and their strain rate, has influenced the resin flow behaviour during curing process. It therefore is an important property related to product performance of the composite. In this paper, a short review on the rheological studies of fiber reinforced composites for both, synthetic and natural based fibers, respectively, are presented. The review summarized the research papers in which include experimental, theoretical and/or modeling works that related to the rheological behaviour that affects the processing. In addition to that, this review paper highlighting a few research studies conducted in literature on the main factor affecting the rheological quality and lead to effect the performances of the composite. The aims of this short review, mainly to capture the trend ranging from the recent five years back and summarize the various studies carried out whether via experimental, theoretical or modeling works. Furthermore, it is also aiming to highlight the significance effects of rheological properties and answering on why is it important to study the scenario, with the compilation of research paper studies on the rheological studies. The finding of this review aims to provide ideal information regarding rheological behaviour to ensure a better quality of pre-preg product can be produced in the author's work.*

Keywords: *Rheological; pre-impregnation; fabric composites)*

A REVIEW OF INTERNAL RESISTANCE AND TEMPERATURE RELATIONSHIP, STATE OF HEALTH AND THERMAL RUNAWAY FOR LITHIUM-ION BATTERY BEYOND NORMAL OPERATING CONDITION

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Abstract: *One of the most popular energy sources in electrical circuitry is lithium-ion battery (LIB) and it can be found in variety of products from the smallest unit such as Airpod, smartwatch, smartphone to as big as farming drones, industrial robots, and electric vehicles. But the usage of lithium-ion battery is limited to a range of temperature. The normal operating temperature range for LIB is 40°C~65°C. Despite, there are still cases where operating LIB at high temperature is unavoidable for example deep earth pipeline inspection in oil & gas industry, sterilization of medical tools in medical industry, harsh condition robots and drones in industrial sector, and high ambient power storage for photovoltaic system. Operating LIB beyond normal condition will affect the battery in several ways. In this paper, the effect of temperature on internal resistance is demonstrated by several studies, the results show LIB internal resistance decrease as temperature increase. Operating LIB beyond normal operating condition can also leads to faster battery degradation. Battery state of health (SOH) is used to indicate battery degradation level. A battery with low SOH performs poorly in terms of power delivery compared to high SOH battery. In addition, on beyond normal operating condition, stresses such as thermal stress can damage the battery and instigate thermal runaway causing violent combustion and explosion.*

Keywords: *Lithium-ion battery; High operating temperature; Internal resistance; State of health; Thermal runaway*

PENG-ROBINSON CUBIC EQUATION OF STATE BASED ON KEY GROUP CONTRIBUTION AND CALCULATION OF NITROGEN GAS SOLUBILITY IN MMA DIMER

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Abstract: *Previously authors have reported facts that nitrogen (N₂) and oxygen solubilities in styrene is the same as those in benzene and divinylbenzene at 303 K. Though the three compounds have an atomic composition, (CH)_n (n=6, 8 and 10), the gas solubilities are thought to depend on the number of aromatic carbons in the solution. Then, authors named it 'a key group in solubility'. In this research, the key group was investigated for N₂ solubility in methyl methacrylate (MMA) and its dimer, ethylene glycol dimethacrylate (EGDMA). Therefore, the calculations were carried out by Peng-Robinson (PR) equation of state based on group contribution methods. The experimental data employed were those of Lai et al., where N₂ solubility are reported in MMA at 313 K. The N₂ solubility in EGDMA was assumed to be double of that in MMA at 303 K, because EGDMA has two MMA units in the molecule. Two types of group contribution methods were proposed to calculate N₂ solubility in EGDMA. One was for the critical temperature and pressure proposed by Joback and Reid. Using these properties, the attractive and excluded volume parameters in PR equation were evaluated for EGDMA. Other was similar to a method proposed by Orbey and Sandler. The excluded volume parameter in PR equation can be evaluated from those of MMA by multiplying the number of repeating units, and the attractive by multiplying the squared number. Instead of the method, the powers were proposed to be 3/4 and 3/2 for the excluded volume and attractive parameters, respectively. The powers are come from a scaling theory by de Gennes. The binary parameter for N₂ – EGDMA was also set to $k_{12} = 0.226$, which was the same as that for N₂ – MMA. The calculated N₂ solubility in EGDME was far smaller than the hypothetical N₂ solubility in EGDMA at 303 K. Otherwise, by setting $k_{12} = -0.020$ with the method by Joback and Reid, the calculation agreed well with the hypothetical data.*

Keywords: *Gas solubility, Vinyl monomer, Group contribution; Peng-Robinson equation of state; Scaling*

MODELLING AND VALIDATING THE SPRAY CHARACTERISTICS OF A CO-AXIAL TWIN-FLUID ATOMIZER USING OPENFOAM

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Abstract: *Today, the applications of sprays cover a wide range of fields. Their role in internal combustion engines is instrumental in maintaining higher engine efficiency. A deeper understanding of the liquid-gas phase interaction in sprays is crucial to the atomization process. The methods and models used in the simulations have their challenges due to the various discretization schemes and solutions used. To develop and validate the computational models, well defined experimental data is required. In the present work, spray characteristics were studied numerically through OpenFOAM. As the spray characteristics are closely linked with the liquid breakup length, this study focuses on the primary breakup phenomena and the breakup length of the liquid jet emanating from the twin-fluid co-axial flow atomizer. Numerical simulations were performed for a wide range of initial conditions and the breakup length of the spray was validated against the experimental observed by Sivadas et al., 2013. These simulations were carried out using a Eulerian based VOF solver that models the fluid as a continuum. K-Epsilon model was used to predict the turbulent nature of the spray. The air and water velocities were varied between 19.0 to 31.3 m/s and 0.7 to 1.8 m/s respectively. The proposed model was able to predict the computed breakup length within 20% of the experimental values. The present model can be further extended to test for a co-axial swirl injector to predict finer spray formation.*

Keywords: *OpenFOAM; spray characteristics; Eulerian method; VOF*

THE PERFORMANCE OF CALCIUM CHLORIDE AND SILICA GEL AS SOLID DESICCANT DEHUMIDIFIER FOR INDOOR AIR QUALITY

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Abstract: *The desiccant materials were recently discovered as an alternative option as a dehumidifier by possessing the hygroscopic properties naturally as well as low energy needed towards its application. This paper discussed the performance analysis by selected desiccants for dehumidification purpose. Several analyses such as dehumidification ability test and an indoor air quality (IAQ) test were carried out. The dehumidification ability test used a controlled environment of 25°C, RH 70% and 2 m/s. Meanwhile, the indoor air quality test used a naturally ventilated office room with six indoor air parameters (relative humidity, air velocity, air temperature, PM10, airborne bacteria count and ventilation indicator). Brand A (0.6823 g/kg) and brand B (0.6849 g/kg) had a relatively good dehumidification ability during the 45-minute dehumidification ability test compared to brand C (0.3108 g/kg) and brand D (0.3982 g/kg). The IAQ test showed that brand A had the largest difference of 13.12 % for the indoor-outdoor relative humidity while brand D had the lowest difference of 11.83%. Brand B had the highest average respirable particulate matter concentration of 0.037 µg/m³. The airborne bacterial count for all conditions had no statistical significance, indicating the application of desiccants were not effective in reducing airborne bacteria.*

Keywords: *Calcium chloride; silica gel; solid desiccant; performance analysis; dehumidification.*

SIMULATION OF EPOXY RESIN FLOW ON RADOME MOULD USING WOVEN FLAX FIBRE AND GLASS FIBRE WITH VACUUM INFUSION PROCESS

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Abstract: *The vacuum infusion method is emerging to produce composite parts especially aircraft radome. Low speed aircraft radome has a thin wall structure. Ansys Fluent is used in optimization phase for resin flow analysis on aircraft radome part. The infusion strategy by locating the inlet and outlet of any part is crucial for the resin to impregnated at all surface area. Permeability fibre, K is one of the parameters influence the infusion strategy based on Darcy's law. Permeability value is not constant, and it is depending on the fibre and resin used for the product. In this work, flax fibre, glass fibre and low viscosity resin are used to determine the permeability value of flax fibre, glass fibre and hybrid without using flow medium. In-plane experiment on reinforcement fibre permeability is conducted and all reinforcement fibre have similar fibre architecture and weight. The development of digital model from a top partial aircraft radome is obtained through a 3D scanner and CATIA. Ansys Fluent is used to optimize the location of inlet and outlet for the epoxy. Also, the epoxy must fill up all the surface area before epoxy gel time. The Ansys Fluent analysis model is validated through the in-plane experiment filling time result for flat model. Based on the simulation analysis, the location of the inlet is placed at the perimeter and outlet at the centre. The filling time from the simulation for the flax fibre and hybrid fibre was estimated around 10 to 11 minutes. However, the filling time for glass fibre is approximate 2 hours which is longer than epoxy gel time. The permeability value can be calculated using Darcy's law through in-plane experiment. Furthermore, this method can used to estimate filling time of thin wall structure within gel time of the resin.*

Keywords: *Permeability; Vacuum infusion; Mould design; Aircraft radome*

INVESTIGATION OF THE PHYSICAL PROPERTIES ON THE BIODIESEL SAMPLES

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Abstract: Biodiesel production is the reaction of raw oils with mixing and heating within catalyst and methanol. The raw oils usually come from vegetable oils and animal fats. Vegetable oils are a promising feedstock for biodiesel production since they are renewable in nature. Nevertheless, the physical properties of biodiesel pose some acute problems when used in an unmodified engine. It is important to diesel and biodiesels because it impacts components such as the fuel pump. Therefore, this paper intends to investigate the properties of biodiesel samples in terms of viscosity, density, flash point and acid values at different bio lipids and different mixing time. The evaluation is carried out on the three types of biodiesels: crude oil, crude palm oil, corn oil, and waste cooking oil. Methanol was chosen over the others for the transesterification process because it was cheaper. The esterification process, which reduces the amount of free fatty acids in the crude oil, will be performed with the help of an acid catalyst. Alkaline catalysts, in contrast, are used for the transesterification process. The comparison of all the samples shows that CPO is the better biodiesel than the other due to the physical properties of kinematic viscosity, density and flashpoint.

Keywords: Minimum three keywords; avoid too general and too specific keywords; CDF Letters

NUMERICAL INVESTIGATION OF HEAT TRANSFER INSIDE PARTICIPATING MEDIA: BUILT THERMAL ENVIRONMENT APPLICATION

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Abstract: *This paper is devoted to studying the effect of volumetric radiation on coupled convection and radiation heat transfer in a participating two-dimensional enclosure with emitting absorbing and scattering medium which is a crucial criterion in design of built thermal environment. Radiative information is gotten by resolving RTE (the radiative transfer equation) by means of CVFEM (the Control Volume Finite Element Method). Temperature, density and velocity fields are calculated using the mesoscopic two double population lattice Boltzmann approach. Results are validation of results with existing works in literature and the proposed approach was found to be numerically stable, efficient and accurate.*

Keywords: *Built thermal environment, convection; radiative transfer equation; double population. CVFEM; LBM.*

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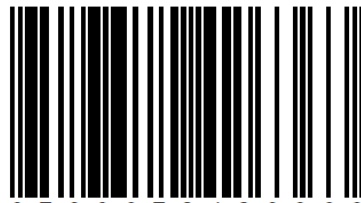
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GAE'S CONFERENCES 2021



2nd Penang International Multidisciplinary Conference 2021 (2nd PIMC 2021)

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Website: <https://submit.confbay.com/conf/pimc2> @ <http://2pimc2021.egax.org/>

Email: pimcconferences@gmail.com; conference2@egax.org



4th International Conference on Global Business and Social Science 2021 (4th ICBSS 2021)

Date: 20-21 February 2021

Venue: Kuala Lumpur, Malaysia

Website: <https://submit.confbay.com/conf/4icgbss2021> @ <http://icgbss2021.egax.org/>

Email: icgbssofficial@gmail.com; conference2@egax.org



3rd Langkawi International Multidisciplinary Conference 2021 (3rd LIMC 2021)

Date: 13-14 March 2021

Venue: Langkawi, Malaysia

Website: <https://submit.confbay.com/conf/limc3> @ <http://3limc2021.egax.org/>

Email: limcconf2019@gmail.com; conference2@egax.org



6th International Conference on Education, Business, Islamic and Technology 2021 (6th ICEBIT 2021)

Date: 3-4 April 2021

Venue: Ipoh, Perak, Malaysia

Website: <https://submit.confbay.com/conf/icebit6> @ <http://icebit2021.egax.org/>

Email: icebitofficial@gmail.com; conference2@egax.org



5th International Conference Business, Tourism and Technology 2021 (5th ICBTT 2021)

Date: 24-25 April 2021

Venue: Online

Website: <https://submit.confbay.com/conf/icbtt5> / <http://icbtt2021.egax.org/>

Email: icbttofficial@gmail.com; conference2@egax.org



5th ICGBSS 2021

**5th International Conference on Global Business and Social Science 2021
(5th ICGBSS 2021)**

Date: 27-28 May 2021

Venue: Kuala Lumpur, Malaysia

Website: <https://submit.confbay.com/conf/icgbss5> @ <http://5icgbss2021.egax.org/>

Email: icgbssofficial@gmail.com; conference2@egax.org



3rd IRCMST 2021

**3rd International Research Conference on Multidisciplinary in Social Sciences and
Technology 2021 (3rd IRCMST 2021)**

Date: 26-27 June 2021

Venue: Cameron Highland, Malaysia

Website: <https://submit.confbay.com/conf/ircmst3> @ <http://ircmst2021.egax.org/>

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2nd IRCASE 2021

**2nd International Research Conference on Applied Sciences and Engineering 2021
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Date: 26-27 June 2021

Venue: Cameron Highland, Malaysia

Website: <https://submit.confbay.com/conf/ircase2> @ <http://2ircase2021.egax.org/>

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ICAT 2021

**International Conference on Applied Thermofluids & Computational Fluids Mechanics
(ICAT 2021)**

Date: 26-27 June 2021

Venue: Cameron Highland, Malaysia

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2nd ICMASIT 2021

**2nd international Conference on Multidisciplinary Approaches in Social Sciences, Islamic
and Technology (2nd ICMASIT 2021)**

Date: 3-4 July 2021

Venue: Langkawi, Malaysia

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**4th International Conference on Tourism, Technology and Business Management 2021
(4th ICTTBM 2021)**

Date: 1-2 August 2021

Venue: Kota Bharu, Kelantan, Malaysia

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**4th International Research Conference on Humanities, Social Sciences and Technology 2021
(4th IRCHST 2021)**

Date: 21-22 August 2021

Venue: Kuala Lumpur, Malaysia

Website: <https://submit.confbay.com/conf/irchst4> @ <http://irchst2021.egax.org/>

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2nd International Conference on Innovation Approaches in Business, Education and Technology (2nd ICIABET 2021)

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Venue: Cameron Highland, Malaysia

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3rd Penang International Multidisciplinary Conference 2021 (3rd PIMC 2021)

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4th Langkawi International Multidisciplinary Conference 2021 (4th LIMC 2021)

Date: 20-21 November 2021

Venue: Langkawi, Malaysia

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4th IRCMST 2021

4th International Research Conference on Multidisciplinary in Social Sciences and Technology (4th IRCMST 2021)

Date: 27-28 November 2021

Venue: Kuala Lumpur, Malaysia

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5th IRCHST 2021

5th International Research Conference On Humanities, Social Sciences and Technology (5th IRCHST 2021)

Date: 11-12 December 2021

Venue: Kota Bharu, Kelantan, Malaysia

Website: <https://submit.confbay.com/conf/irchst5> @ <http://5irchst2021.egax.org/>

Email: irchstofficial@gmail.com; conference2@egax.org



3rd IRCASE 2021

3rd International Research Conference on Applied Sciences and Engineering 2021 (3rd IRCASE 2021)

Date: 11-12 December 2021

Venue: Kota Bharu, Kelantan, Malaysia

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Email: ircaseofficial@gmail.com; conference2@egax.org



5th ICIEL 2021

5th International Conference on Islamic, Education and Law 2021 (5th ICIEL 2021)

Date: 18-19 December 2021

Venue: Ipoh, Perak, Malaysia

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Email: icielofficial@gmail.com; conference2@egax.org



**International Virtual Conference on Social Sciences, Engineering and Technology 2021
(IVCoSET 2021)**

Date: 8 September 2021

Venue: Online

Website: <https://submit.confbay.com/conf/ivcoset2021> @ <http://ivcoset2021.egax.org/>

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**International Virtual Conference on Engineering, Innovation and Social Sciences 2021
(IVCEIS 2021)**

Date: 2 December 2021

Venue: Online

Website: <https://submit.confbay.com/conf/ivceis2021> @ <http://ivceis2021.egax.org/>

Email: ivceisofficial@gmail.com; conference2@egax.org



**International Virtual Conference on Social Sciences, Education and Innovation 2021
(IVCoSEI 2021)**

Date: 14 June 2021

Venue: Online

Website: <https://submit.confbay.com/conf/ivcosei2021> @ <http://ivcosei2021.egax.org/>

Email: ivcoseiofficial@gmail.com; conference2@egax.org

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