

# MMCITRE | 2021

2nd International Conference on  
Mathematical Modeling, Computational  
Intelligence Techniques and Renewable  
Energy

6th - 8th  
February

# SOUVENIR



**Organized By**

Department of Mathematics  
School of Technology  
Pandit Deendayal Petroleum University

**In Association With**

Forum of Interdisciplinary Mathematics



**PDPU** PANDIT  
DEENDAYAL  
PETROLEUM  
UNIVERSITY

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**2<sup>nd</sup> International Conference  
on  
Mathematical Modeling, Computational Intelligence Techniques and  
Renewable Energy  
(MMCITRE - 2021)**



**SOUVENIR**

**Department of Mathematics  
SCHOOL OF TECHNOLOGY  
PANDIT DEENDAYAL PETROLEUM UNIVERSITY,  
Gandhinagar, Gujarat, India.**

**February 06 – 08, 2021**



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**Dr. Manoj Sahni** (Associate Professor and Head, Department of Mathematics)

Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India

**Prof. José M. Merigó Lindahl** (Professor),

University of Chile, Chile & University of Technology Sydney, Australia

**Dr. Ritu Sahni** (Assistant Professor)

(Institute of Advanced Research, Gandhinagar, Gujarat, India)

**Dr. Rajkumar Verma** (Postdoc Fellow)

University of Chile, Chile

## 2. Messages:

**Governor of Gujarat**

- Shri Acharya Devvrat

**Chief Minister of Gujarat**

- Shri Vijay Rupani

**Chief Patron: Director-General (PDPU)**

- Prof. S. Sundar Manoharan

**Patron: Director, School of Technology (PDPU)**

- Prof. Sunil Khanna

**Chairman: Director, Academic Affairs (PDPU)**

- Prof. Tajinder Pal Singh

**Director, School of Petroleum Technology (PDPU)**

- Prof. Rakesh Kumar Vij

**Director, School of Liberal Studies (PDPU)**

- Prof. Nigam Dave

**Dean, Research and Development (PDPU)**

- Prof. Anirbid Sircar

**Chief Guest: Chancellor of K.R. Mangalam University**

- Prof. Dinesh Singh

(Former Vice Chancellor of University of Delhi and

Adjunct Professor of Mathematics, University of Houston and

Distinguished Professor, SGT University)

### Guest of Honor:

**Former Prof. Clark Atlanta University, Atlanta, USA ;**  
JIIT, Noida India, University of Delhi, India

- Prof. Bhudev Sharma

**Pro - Chancellor, GLA University**

- Pro. D. S. Chauhan

(Former Vice Chancellor Uttar Pradesh Technical University,  
Uttarakhand Technical University, Lovely Professional University,  
Jaypee University of Information Technology

**President Association of Indian Universities  
and Vice-Chancellor, GBPUAT, Pantnagar**

- Prof. Tej Pratap

**President of Forum for Interdisciplinary Mathematics  
and Professor Emeritus at Waseda University, Japan**

- Prof. Junzo Watada

**Honorary Professor of Mathematics  
at GJ University of Science and Technology, Hisar**

- Prof. D.S. Hooda  
(Former Pro Vice Chancellor  
of Kurukshetra University)

### **Other Distinguished Speakers Messages**

**Prof. (Dr.) Ernesto Leon Castro**, Universidad Católica de la Santísima Concepción,  
Chile

**Prof. (Dr.) Sanjeev Sharma**, Professor at Department of Mathematics and Associate  
Dean (SDAR) at Jaypee Institute of Information Technology, Noida, U.P. India

**Dr. Arvind Kumar Gupta**, Head, Department of Mathematics at Indian Institute of  
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## WELCOME NOTE

Distinguished Speakers, Delegates and Participants,

Greetings to one and all!!

On behalf of the Organizing committee, it gives us the immense warmth and great pleasure to welcome all of the great scientists, academicians, young researchers, Business delegates and students from all over the world to this **2<sup>nd</sup> International Conference on Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy (MMCITRE 2021)** during 06 - 08 February, 2021 at Department of Mathematics, School of Technology, Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India.

When we have planned up to organize this 2<sup>nd</sup> International Conference (MMCITRE-2021), we knew that it demands hard work and excellent team work. Although we were highly motivated by the grand success of 1<sup>st</sup> International conference (MMCITRE-2020), though it becomes a big challenge for us to systematically arrange the conference in a pandemic. This is an incredible difficult time in all ways. We were apprehensive and in need of motivational words.

We are ecstatic and overjoyed to share that we have received the inspirational messages from our most Honourable leaders including **Shri. Acharya Devvrat (Governor of Gujarat, India)** and **Shri. Vijaybhai Rupani (Chief Minister of Gujarat, India)**. We are indeed honoured to receive their golden words in the form of messages. We learnt that no difficulties get in the way of your work. Their motivational words inspire us to all organizing committee members and all the young students who worked as a team from the first day for the success of this conference.

Organizing such a huge event takes enormous courage, endurance and dedication; we would like to express our gratitude to our **Director General, Prof. S. Sundar Manoharan** for their motivation, great support and advice. He gently kept us on track on all tasks and deadlines. We are also grateful to our **Director, School of Technology, Prof. Sunil Khanna**. He has been amazing in their professional support and encourages us in all ways. We also want to thank our **Director, Academic affairs, Prof. T. P. Singh**, as without his help it wouldn't have been possible to organize this massive event without any hurdle. He is that strong pillar

of the Department whose presence only gives us courage. We cannot thank enough to our **Director, School of Petroleum Technology, Prof. R. K. Vij**, **Director, School of Liberal Studies, Prof. Nigam Dave** and **Dean, Research and Development, Prof. Anirbid Sircar** for their motivational words and best wishes. Many thanks to all of you!!

Any successful conference is augmented by an exciting group of dignitaries and special events. We are indeed honored to pen the first words as a welcome message to our world-renowned teachers, researchers and Academicians. We wish to express our profound gratitude to our **Chief Guest Professor Dinesh Singh, Chancellor K.R. Mangalam University, former Vice-Chancellor, University of Delhi, conferred with the Padma Shri**, the fourth highest civilian award awarded by the Republic of India, who has kindly agreed to be with us to witness this memorable occasion. We also like to express our deepest gratitude to our Guest of Honour, **Prof. Bhudev Sharma, former Professor at Clark Atlanta University, Atlanta, GA, USA, former President (same as Vice Chancellor) of Hindu University of America, Orlando, Florida** for joining us. We are blessed from his thoughtfulness and generosity. We are also deeply thankful to our Honoured Guest **Prof. D. S. Chauhan, Pro - Chancellor, GLA University** for blessing us with your presence. Your Prudent words inspires us. We sincerely thank our Honoured Guest **Prof. Tej Pratap, President Association of Indian Universities and Vice-Chancellor, GBPUAT, Pantnagar** who did us the Honour by sending his message for this memorable event. We also want to express immense pleasure to share that **Prof. Junzo Watada, the President of Forum for Interdisciplinary Mathematics and Professor Emeritus at Waseda University, Japan** joined our event and bestowed us by being Guest of Honor. We want to communicate our utmost regard to another Guest of Honour **Prof. D.S. Hooda, Honorary Professor of Mathematics at GJ University of Science and Technology, Hisar (Former Pro Vice Chancellor of Kurukshetra University)** for offering his unconditional support and precious time.

We are Deeply thankful to all our keynote Speakers **Prof. B.V. Rathish Kumar** from Indian Institute of Technology Kampur, **Prof. José M. Merigó Lindahl** from University of Chile, Chile and University of Technology Sydney, **Prof. Martinez Lopez, Luis** from the University of Jaén, Spain **Prof. Sanjeev Sharma** from Jaypee Institute of Information Technology, Noida, **Prof. Nita H. Shah** from Gujarat University Ahmedabad, **Prof. Ernesto Leon Castro**, from Universidad Católica de la Santísima Concepción, Chile, **Prof. Arvind Kumar Gupta**, from Indian Institute of Technology Ropar, **Prof. Nutan Kumar Tomar** from Indian Institute of Technology Patna, **Prof. H.C. Taneja** from Delhi Technological University, Delhi, **Prof. Elisabeth Amudhini** from Karunya University of Technology and Sciences Coimbatore, **Dr. Christian Cancino** from University of Chile,

**Dr. Anuja Arora** from Jaypee Institute of Information Technology Noida and other distinguished Speakers. We would also welcome all our International and National Advisory Committee members for their continuous support throughout the Conference.

The heart of the conference is not only in the organization, but in the hard work of the students committee and all the support provided by the Departmental members, staffs of the administration, accounts office, registrar office, amenities, computer labs and ITadmin. Thank you for sharing your work with everyone else and for joining us in the success of an incredible conference.

Our Chief Guest, all the Honoured Guest and Keynote Speakers are the Gems of Mathematics. They are sort of encouragement for all of us. We believe that this conference provides the platform for the young researchers to interact with these eminent researchers and scientists across the globe.

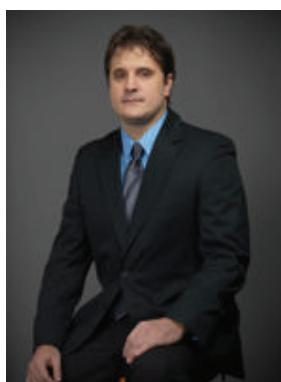
In this conference an equal opportunity is provided to all the participants to share their ideas in the area of Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy. The research groups involved are not only mathematicians but also engineers, physicists, biologists, and many more. These three days International Conference includes several research problems dealing with mathematical modeling of various real-life phenomenon, computational techniques and research articles based on mathematical modeling of renewable energy.

Once again, we are very happy to welcome you all in this international event to exchange your views and share experience with internationally renowned Professors, Researchers, Colleagues and Students representing many well-known Universities and Research Institutions. Thank you for your participation.



A handwritten signature in blue ink.

Dr. Manoj Sahni



A handwritten signature in blue ink.

Prof. José M.  
Merigó Lindahl



A handwritten signature in blue ink.

Dr. Ritu Sahni



A handwritten signature in blue ink.

Dr. Rajkumar Verma

**Shri. Acharya Devvrat (Governor of Gujarat, India)**



**Acharya Devvrat**  
Governor, Gujarat  
Gandhinagar-382021



**आचार्य देवव्रत**  
राज्यपाल, गुजरात  
गांधीनगर-३८२०२१

— 5 JAN 2021

**MESSAGE**

I am pleased to learn that the Department of Mathematics of Pandit Deendayal Petroleum University, Gandhinagar is going to organize its second international conference on "Mathematical Modeling, Computation Intelligence Techniques and Renewable Energy" in association with the Forum for Interdisciplinary Mathematics.

I hope this Conference will provide an interactive platform to aspiring students and researchers. It will give an equal opportunity to all the participants to share their ideas in the field of Interdisciplinary mathematics, statistics, computation intelligence and renewable energy.

I wish all success to the Conference and publication of souvenir as well.

A handwritten signature in blue ink, appearing to read "Acharya Devvrat".

(Acharya Devvrat)

**Shri. Vijay Rupani (Chief Minister of Gujarat, India)**



### **Message**

*“Breakthrough innovation occurs when we bring down boundaries and encourage disciplines to learn from each other”.*

- Gyan Nagpal

Life has two aspects, the emotional aspects of life don't have any space for the mathematics, but the practical aspect of the life has always special place for the mathematics. Once upon a time all the disciplines were self sufficient, but in contemporary age of science and technology, the importance of inter-disciplinary confluences is taking lead to satisfy the needs of the time.

It is heartening to learn that the Department of Mathematics of Pandit Deendayal Petroleum University (PDPU) is organizing 2<sup>nd</sup> International Conference on “Mathematical Modeling, Computational Intelligence Technique, and Renewable Energy during 06 to 08 February 2021 at Pandit Deendayal Petroleum University, Gandhinagar. I, hereby, extend my heartiest best wishes to the organizers, all the participants for the grand success of the Conference and the Souvenir being published to commemorate the event.

  
**(Vijay Rupani)**

To,  
Dr. Manoj Sahni, Corresponding Chair  
MMCITRE - 2021,  
Department of Mathematics,  
School of Technology Pandit Deendayal Petroleum University,  
Gandhinagar – 382007.  
Email: manoj.sahni117@gmail.com

**Chief Patron**  
**Prof. S. Sundar Manoharan**  
**Director-General**  
**Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India**



**Message**

At the outset let me greet each one of you a Happy New Year 2021. Last year has been a year of the effect and impact of data analytics, predict the effect and impact of Covid – 19. It has been an overwhelming experience for the entire University.

The Department of Mathematics, School of Technology at Pandit Deendayal Petroleum University (PDPU) Gandhinagar reflects the old-yet-new character of the discipline itself. Since 2011 the department is playing a significant role in the building up of a sound scientific base in the country through the active interaction of its faculty and alumni with major industries, national laboratories and other research and development institutions in India and abroad, and has stimulated a continuous quest for challenging new directions in teaching, research and development activities in interdisciplinary areas.

I am happy to learn that the 2<sup>nd</sup> International Conference on Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy (MMCITRE-2021) is scheduled to be held in the Department of Mathematics, School of Technology of Pandit Deendayal Petroleum University (PDPU) Gandhinagar during February 6<sup>th</sup> – 8<sup>th</sup>, 2021. This is the second time that such a conference is being held not only in Gandhinagar, but also in Gujarat. I am confident that this conference enables the delegates to share their research experiences and ideas for the growth of technology in the emerging discipline of Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy. I wish this conference a grand success.

A handwritten signature in blue ink, appearing to read "Sundar Manoharan".

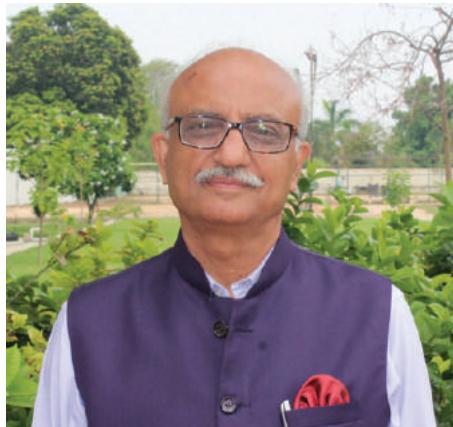
**Prof. S. Sundar Manoharan**  
**Director General (PDPU)**

**Patron**

**Prof. Sunil Khanna**

**Director, School of Technology**

**Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India**



**Message of Congratulations**

It gives me immense pleasure to know that the Department of Mathematics, School of Technology is organizing **2<sup>nd</sup> International Conference on “Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy (MMCITRE - 2021) from February 06 – 08, 2021**. I hope that the Conference will provide a unique platform for academia and researchers from National and International participants. I am confident that the deliberations in the said conference will bring out new ideas for exploring the applications of mathematics in diverse domains of science and engineering. I am sure that the conference will provide a highly rewarding and inspiring experience for the students, researchers and faculties from India and abroad.

With Best Regards,

A handwritten signature in black ink that reads "Sunil Khanna".

**Prof. Sunil Khanna**  
**Director**  
**School of Technology,**  
**Pandit Deendayal Petroleum University,**  
**Gandhinagar, Gujarat,**  
**India.**

**Chairman**

**Prof. Tajinder Pal Singh**

**Director, Academic Affairs**

**Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India**



**Message of Congratulations**

We are delighted to welcome you to the **2<sup>nd</sup> International Conference on Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy (MMCITRE-2021)** organized by Department of Mathematics, School of Technology, Pandit Deendayal Petroleum University (PDPU), Gandhinagar, Gujarat, on February 06 - 08, 2021.

Mathematics makes our life orderly and prevents chaos. Certain qualities that are nurtured by mathematics are power of reasoning, creativity, abstract or spatial thinking, critical thinking, problem-solving ability and even effective communication skills.

Also, Mathematics is the backbone for the development of scientific and technical fields. The conference will provide a forum for interaction of Interdisciplinary Researchers in the field of Engineering, Science and Mathematics. The presence of large number of professionals, academicians and researchers would generate high level of intellectual deliberations and would inspire younger scientists and faculty to go to greater heights.

The Conference Organizing Committee will make every possible effort to make sure that your participation will be scientifically rewarding and a pleasurable experience of our hospitality.

I welcome you to our campus and wish you a successful conference.

A handwritten signature in black ink, appearing to read "Singh".

**Prof. Tajinder Pal Singh**

**Director, Academic Affairs**

**Pandit Deendayal Petroleum University,**

**Gandhinagar, Gujarat, India**

**Prof. Rakesh Kumar Vij**  
**Director, School of Petroleum Technology**  
**Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India**



**Message of Congratulations**

The logo of Pandit Deendayal Petroleum University features a circular emblem with a central flame or oil drop, surrounded by the university's name in English and Hindi.

**PANDIT DEENDAYAL PETROLEUM UNIVERSITY**  
Raisan, Gandhinagar - 382007, Gujarat, INDIA.  
FAX : +91 79 23275030 Website : [www.pdpu.ac.in](http://www.pdpu.ac.in)  
Recognized by the University Grants Commission u/s 2(f)  
NAAC Accredited "A" Grade, (CGPA 3.39 out of 4.00)

SPT 61534

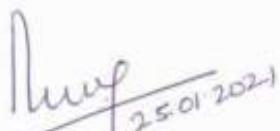
**Letter of Appreciation**

I take this opportunity to extend my heartfelt appreciation to the organizers of the 2<sup>nd</sup> International Conference on Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy.

This conference is a much awaited event that enables young minds to communicate with and learn from experienced researchers. For any area of application, I look at mathematical formulations as controllable form of a conundrum which can be analysed theoretically as well as numerically for deeper insights. From my 42 years of industrial and academic experience, I can say that mathematical modeling is an essential tool to ensure efficient utilization of available resources and modern computing competences in several applications. This conference should be an important platform where experts can discuss the world's most pressing energy challenges and methods to tackle them with the help of mathematical modeling and computational intelligence.

I expect the participants to explore further avenues of research collaboration and make good use of the diverse and outstanding discussions awaiting you at Pandit Deendayal Energy University. You have the best mix of subjects, people and time in front of you!

I wish all the participants the very best.



A handwritten signature in black ink, appearing to read "R.K.Vij". Below the signature, the date "25.01.2021" is written in a smaller, slanted font.

Dr. Rakesh Kumar Vij  
Director – School of Petroleum Technology  
Pandit Deendayal Petroleum University  
Raisan, Gandhinagar - 382007

**Prof. Nigam Dave**  
**Director, School of Liberal Studies,**  
**Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India**



### **Message of Congratulations**

Jordan Ellenberg has written in his book, ‘How Not to Be Wrong: The Power of Mathematical Thinking’, “Dividing one number by another is mere computation; knowing what to divide by what is mathematics.”

What can be a better way than to comprehend energy with mathematical modelling and computational intelligence!

My best wishes and compliments to the Department of Mathematics at PDPU for hosting the International Conference.

With Regards,

A handwritten signature in blue ink, appearing to read "Nigam C." or "Nigam Dave".

**Prof. Nigam Dave,**  
**Director,**  
**School of Liberal Studies,**  
**Pandit Deendayal Petroleum University,**  
**Gandhinagar, Gujarat, India.**

**Prof. Anirbid Sircar**  
**Dean- Research and Development, PDPU**  
**Professor- School of Petroleum Technology**  
**Pandit Deendayal Petroleum University**  
**Gandhinagar, Gujarat, India**



### **Message of Congratulations**

The proposed conference will be of great benefit to students and faculties working in the field of Renewable Energy. Foward modelling and inversion are the fulcrums of mathematical modelling. New technologies like Deep Learning, Supervised and unsupervised machine learning, ANN, Artificial Intelligence etc. are adding new dimensions to mathematical modeling. I wish the conference a huge success.

With Best Regards,

**Prof. Anirbid Sircar**  
**Dean- Research and Development, PDPU**  
**Professor- School of Petroleum Technology**  
**Pandit Deendayal Petroleum University**  
**Gandhinagar, Raisan- 382007**  
**Gujarat, India**

**Chief Guest**  
**Prof. Dinesh Singh**  
**(Chancellor K.R. Mangalam University)**  
**Padam Shri Awardee**



**Message of Congratulations**

I am delighted to learn this 2<sup>nd</sup> International Conference on “Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy” at Pandit Deendayal Petroleum University, Gandhinagar, Gujarat are going to be held from 6 - 8 February, 2021. One of the most important features of a conference is to allow young researchers to gain insights and understanding of the more recent and important happenings in the subject. The theme of the conference is a very appropriate one since it blends the purer parts of mathematics with its applications. I am aware that this conference is designed to particularly help young researchers in India gain a better insight into some very important and relevant areas of mathematics and its applications.

I congratulate Dr. Manoj Sahni and colleagues for the sustained momentum that has brought about his 2<sup>nd</sup> International Conference in spite of the pandemic. I am sure there shall be many good outcomes. Once again hearty congratulations.

I wish it all success.

A handwritten signature in black ink, appearing to read "D. S. Singh".

**Prof. Dinesh Singh**  
**Former Vice Chancellor, University of Delhi**  
**Chancellor, K. R. Mangalam University**  
**Adjunct Professor of Mathematics, University of Houston**  
**Distinguished Professor, SGT University**

**Guest of Honor**

**Prof. BhuDev Sharma, Ph.D.**

**(Former Professor of Mathematics at Clark Atlanta University, Atlanta, USA;**

**JIIT, Noida India, University of Delhi, India)**



16<sup>th</sup> February, 2021

Dr. Manoj Sahni  
Department of Mathematics  
Pandit Deendayal Petroleum University  
Gandhinagar, Gujarat.

**Message of Congratulations**

Please accept my greetings and good wishes for organizing the *2<sup>nd</sup> International Conference on Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy*, February 06 - 08, 2021.

With a very successful International conference held last year, I am delighted to see your continued effort for organizing it this year also. The area you are continuing with is important and needs sustained attention of mathematical researches. I am sure Department of Mathematics, School of Technology, Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, will go a long way in nationally and internationally promoting activities and research in mathematics.

Holding International conferences has a good purpose of interacting new ideas and areas. This time holding it virtually will have possibility of much wider International participation.

I congratulate all the organizers of this conference, in particular you and those whose names appear on various committees.

With my best wishes for the success of the conference.

Sincerely,

A handwritten signature in blue ink, which appears to read "BhuDev Sharma".

BhuDev Sharma  
[sharmaforum@yahoo.com](mailto:sharmaforum@yahoo.com)

**Guest of Honor**

**Prof. D. S. Chauhan**

**Pro - Chancellor, GLA University**

**(Former Vice Chancellor Uttar Pradesh Technical University, Uttarakhand Technical University, Lovely Professional University, Jaypee University of Information Technology)**



**Message of Congratulations**

Wishing you and your committee lots of luck! The efforts to gather knowledge is always too little too late and the secret of getting ahead is getting started. I must say that this conference is the one that hits the spot. This is a right place for all the educationalists to exchange their knowledge and new ideas. The chosen topic "**Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy**" is very interesting and applicable to real world problems. It not only includes researchers involved in mathematical modeling but also scientists from various fields of engineering and the people working in the energy sector. I am glad to know the participation is not only from Gujarat but also from all the States and Union Territories of India. Also, many researchers from outside India are also taking part in this International Conference. I appreciate the work and labor of Dr. Manoj Sahni and his organizing team. You people are unstoppable. I wish this conference a grand Success.

Keep up the Good Work!

A handwritten signature in blue ink on a light-colored background. The signature reads "D S Chauhan".

**Professor D. S. Chauhan**

**Pro-Chancellor, GLA University**

## Guest of Honor



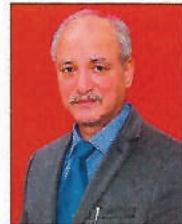
डा० तेज प्रताप  
कुलपति  
Dr. TEJ PARTAP  
Vice-Chancellor

गोविन्द बलभद्र पंत कृषि एवं प्रौद्योगिक विश्वविद्यालय  
पंतनगर - 263145, जिला - झज्जरसिंह नगर (उत्तराखण्ड) भारत  
G.B. Pant University of Agriculture & Technology  
Pantnagar - 263145 (Uttarakhand) India

January 21, 2021

### MESSAGE

I am pleased to learn that the Department of Mathematics of Pandit Deendayal Petroleum University, Gandhinagar, Gujarat is organizing its Second International Conference on "Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy" in association with the "Forum for Interdisciplinary Mathematics" from February 06-08, 2021.



I hope this Conference will definitely provide the platform for researchers to interact with eminent scientists of the world and exchange new knowledge & recent developments in all aspects of computational techniques, mathematical modeling, energy systems etc.

On behalf of Association of Indian Universities (AIU), I convey my best wishes for success of the Conference.

  
( TEJ PARTAP )  
President,  
**Association of Indian Universities/**  
**Vice-Chancellor,**  
**GBPUAT, Pantnagar**

**Guest of Honor**  
**Prof. Junzo Watada**  
**Professor Emeritus, Waseda University, Japan**



### **Message of Congratulations**

I am quite happy to convey the congratulations to all of you: all the invited distinguished guests, all attendants and the chairs and organizers of the conference. It is nice for us to have this second international conference on Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy at Pandit Deendayal Petroleum University, Gandhinagar, India on 6-8 Feb. 2021.

From the late 2019 we had COVID-19 and faced very hard days till now. We appreciate the conference organizing committee spent much effort to open the second conference today. Till now we have faced new several different types of corona virus. All over the world we have several strong surges of corona and locked down in various places which prohibit us from meeting face to face at the conference site. But this online meeting enables us to easily attend the conference similar to the last first conference without crossing the globe.

I would like to emphasize the personal expectation for this conference.

(1) We understand that our globe cannot survive without reduced the consumption of fossil energy and reduce CO<sub>2</sub>. For this target, in 2015 the United Nation reached the contract of SRDs to realize the sustainable development goals (SDGs) till the year 2030.

(2) From FIM viewpoints, we can understand the world structure and phenomena from mathematics and mathematical modeling. From my opinion, it does not mean to use equations and variables. I think it is important to consider the world through mathematical concept and mathematical modeling even though we do not use equations and variables. Such methodologies give huge influence and enable for us to understand various phenomena which include social and humanity sciences. Hopefully this concept combines the mathematics with the world of computation and energy towards SRDs.

I wish this conference can support the creation of a new perspective of research on Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy. We can deal with very wide range topics from mathematics. I wish all attendants including the people newly joined from this conference and the repeaters from the first one can enjoy this meeting and share the new concepts and innovative results in the discussion.

At the end I would like to thank the chairs and organizing committees as well as many students have spent huge time to prepare the conference well for reaching the today's opening.

A handwritten signature in black ink, appearing to read "渡田淳三".

**Prof. Junzo Watada,**  
**Professor Emeritus Waseda University, Japan**

**Guest of Honor**  
**Professor D. S. Hooda**  
**Honorary Professor of Mathematics,**  
**GJ University of Science and Technology, Hisar, India**  
**(Former Pro Vice Chancellor, Kurukshetra University)**



### **Message of Congratulations**

I am extremely happy to know that the 2<sup>nd</sup> International conference on Mathematical Modeling, Computational Intelligence Techniques and Renewable Energy (MMCITRE-2021) is being organized by the Department of Mathematics, Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, from February 6<sup>th</sup> to 8<sup>th</sup>, 2021 jointly with Forum of Interdisciplinary Mathematics.

Lord Bacon once said “Mathematics is the Mother of all Sciences and backbone to all technologies”. There is hardly any subject and field of research where mathematics is not applied. In addition to scientific values, mathematics has cultural values also. It plays a great role in development of personality traits, like logical thinking, scientific temper, power of reasoning, creativity and problems –solving ability.

I congratulate Dr. Manoj Sahni and other members of organizing committee for their untiring efforts in organizing such an important event in very short span of time. I am confident that the conference will facilitate the delegates hailing from India and abroad to share their research findings and experiences for the growth of emerging disciplines in physical sciences, technologies and industries. In the end I wish the conference a grand success.

A handwritten signature in blue ink, which appears to read "D. S. Hooda".

**Prof. D. S. Hooda**  
**Former PVC, Kurukshetra University**

**Prof. (Dr.) Ernesto Leon Castro**  
**Universidad Católica de la Santísima Concepción, Chile**



**Message of Congratulations**

I thank the organizers of the 2<sup>nd</sup> International Conference on "Mathematical Modeling, Computational Intelligence Techniques, and Renewable Energy" for their invitation as Guest Speaker and, in general, for organizing such a distinguished event. The evolution of computational techniques, mathematical modeling, energy systems, applications of fuzzy sets, and many more have generated different research lines. In these conferences, researchers can share their ideas and develop collaborative ties to advance in these topics.

With Regards,

A handwritten signature in blue ink, appearing to read "LEON CASTRO".

**Prof. (Dr.) Ernesto Leon Castro**  
**Universidad Católica de la Santísima Concepción,**  
**Chile.**

**Prof. Sanjeev Sharma**

**Professor at Department of Mathematics and Associate Dean (SDAR)**

**Jaypee Institute of Information Technology, Noida, U.P., India**



### **Message of Congratulations**

Department of Mathematics School of Technology, Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India in Association with Forum for Interdisciplinary Mathematics (FIM) is organizing its 2<sup>nd</sup> International Conference on MATHEMATICAL MODELING, COMPUTATIONAL INTELLIGENCE TECHNIQUES AND RENEWABLE ENERGY during February 06th-08th, 2021.

This conference is another milestone in the series of the International Conference organized last year by the Department of Mathematics, School of Technology, PDPU, Gandhinagar, Gujarat, India. I hope the expertise of the speakers and deliberations will help us opening new wings of learning and research.

The world is witnessing rapid changes in all wings and areas of technology. The changes and advances are mainly driven by the requirements for easing the processes and helping mankind in completing any processes in swifter manner. Progress in research in any of its specialized fields demands sharing of its results and open forum for further critical discussions. Conferences provide platforms for such exchange of experiences and share of expertise. This conference, aims to provide an option for interaction with established researchers, scientists and young minds.

I express my thanks to all delegates for their contribution and the team of organisers for their hard work in fulfilling the theme and making the conference a success. This initiative will provide the opportunity to all the participating scientists, Academicians and researchers to share their research ideas on the common platform and it also provides the new concepts for further research. I hope that this conference will be beneficial for the researchers of this area.

With Regards,

A handwritten signature in blue ink, appearing to read "Sanjeev Sharma". The signature is fluid and cursive, with a distinct 'S' at the beginning.

**Prof. Sanjeev Sharma**

**Professor at Department of Mathematics & Associate Dean (SDAR)**

**Jaypee Institute of Information Technology, Noida.**

**Dr. Arvind Kumar Gupta**  
**Head, Department of Mathematics,**  
**Indian Institute of Technology, Ropar,**  
**Rupnagar, Punjab, India**



### **Message of Congratulations**

I would like to pass my congratulations and gratitude to everyone involved for the upcoming 2<sup>nd</sup> International conference on Mathematical Modeling, Computational Intelligence Techniques and Renewable energy which will be conducted in a Hybrid mode and organized by Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India. This is the second in the series. The first one had been successfully organized physically during February 21 – 23, 2020 in which more than 100 participants shared their knowledge.

I am sure that this upcoming MMCITRE-2021 is going to be a splendid event which will not only provide a common platform for scientist, engineers and early researchers to discuss their research problems but also provide a forum for exchanging ideas, knowledge and experiences among the participants. At this moment, I wish to congratulate the organizing team for their hard work to make the Conference a grand success.

A handwritten signature in blue ink that reads "Arvind Kumar". The signature is fluid and cursive, with a small flourish at the end.

(Dr. ARVIND KUMAR GUPTA)  
Head, Department of Mathematics,  
Indian Institute of Technology, Ropar  
Rupnagar, Punjab, India

## **About Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India**

**(A WORLD CLASS UNIVERSITY WHICH PROVIDES EDUCATION ALONG WITH GREAT OPPORUNITIES AND SUCCESS TO ITS STUDENTS)**



Pandit Deendayal Petroleum University (PDPU) has been established as a Private University through the State Act enacted on 4<sup>th</sup> April, 2007 to create a World Class University in energy education. Pandit Deendayal Petroleum University's 100 acre campus is located in Gandhinagar, which is the capital city of Gujarat and located 23 Km North from a well developed city called Ahmedabad. The primary thrust areas for the university are to ensure ENERGY FOR ALL, creating a larger SOCIAL IMPACT and preparing the YOUTH FOR TOMORROW.

PDPU addresses the need for trained and specialized human resource for Energy, Engineering, Management and Liberal Arts field worldwide. It intends to expand the opportunities for students and professionals to develop intellectual knowledge base with leadership skills to compete in the global arena. This objective is being addressed through a number of specialized and well-planned undergraduate, post-graduate and doctorate education programmes and intensive research initiatives. For development of its faculties and staff the University endeavours for various Joint Exchange and Research programs. PDPU believes in active and continued partnership with Industry and National and International Universities.

## About Forum for Interdisciplinary Mathematics (FIM)



### PRESIDENT

**Prof. Junzo Watada**

**(Professor Emeritus, Waseda University, Japan)**

**<http://forum4interdisciplinarymathematics.org/>**

The Forum for Interdisciplinary Mathematics (FIM) is a registered trust in India. It is, in effect, an India based international society of scholars working in mathematical sciences and its partner areas (a partner area is defined as one where some knowledge of mathematical sciences is desirable to carry out research and development). The society was incepted in 1975 by a group of University of Delhi intellectuals led by Prof. Bhudev Sharma. In 2021, the FIM is running into 46<sup>th</sup> years of active standing.

Right from the beginning, FIM had the support and association of India's great mathematicians and also users of mathematics from different disciplines in the country and abroad. The FIM series publishes high-quality monographs and lecture notes in mathematics and interdisciplinary areas where mathematics has a fundamental role, such as statistics, operations research, computer science, financial mathematics, industrial mathematics, and biomathematics. It reflects the increasing demand of researchers working at the interface between mathematics and other scientific disciplines. Recently first chapter of FIM in India is formed in Gujarat and another chapter is formed in Japan.

FIM membership Annual / Life can be availed by filling membership form which is available on FIM Website:

**[\(http://forum4interdisciplinarymathematics.org/\)](http://forum4interdisciplinarymathematics.org/)**

Life Membership: Rs. 5000/-

Annual Membership: Rs. 500/-

## **Abstracts of Keynote Speakers**

## **The Art of Modelling through the Science of Mathematics**

Prof. Dinesh Singh

Chancellor, K R Mangalam University

Former Vice Chancellor, University of Delhi

Adjunct Professor of Mathematics, University of Houston

Distinguished Professor, SGT University

This talk covers the History of Mathematical Modelling over centuries till the present age.

## **Generalized Information Measures with Application to Multiple Attribute Decision Making under Intuitionistic Fuzzy Environment**

Prof. BhuDev Sharma

Former Professor of Mathematics

Clark Atlanta University, Atlanta, USA, JIIT Noida and Delhi University, Delhi, India

In real-world decision-making situations, different kinds of uncertainties occur in the information data, which makes them too complex and challenging. Zadeh (1965) developed the theory of fuzzy sets to model uncertain and vague concepts more effectively. In 1983, Atanassov (1983) generalized the notion of fuzzy sets and proposed the theory of intuitionistic fuzzy sets, which assigns to each element a degree of membership (DM) and a degree of nonmembership (DNM) with the condition that  $DM + DNM \leq 1$ . In the past years, intuitionistic fuzzy set theory has been studied by several researchers and applied to solve broad range problems related to different areas particularly in decision making. Different information measures such as entropy, divergence etc. are utilized to achieve a final decision in a decision-making process. Parametric generalized information measures give extra flexibility in solving real-life problems by considering various factors during the measuring process.

This talk will provide an overview of the different parametric entropy and divergence measures under an intuitionistic fuzzy environment. Their application in multiple attribute decision-making problems illustrates with some real-life numerical examples.

## **Recent Advances of ANN Studies**

Prof. Junzo Watada,  
Professor Emeritus, Waseda University, Japan

We have worked on artificial neural network (ANN) for 30 years from 1990 after spending 20 years on fuzzy systems and AI research. Recently ANN influences us by the deep learning structure. We intend to talk about our research of ANN to solve problems. We built double-layered ANNs in 1990s to solve mean-variance problems, that is, quadratic programming problems such as portfolio problems in financial engineering. The double-layered ANNs consist of Hopfield machine and Boltzmann machine. The two kinds of ANN collaborate to solve the quadratic mean-variance problems in the way that the upper level ANN selects optimal neurons and the lower level ANN decided each optimal weights, and proved its convergence theoretically. But bi-level programming problem is more complicated. Even bi-level linear programming problem is NP-hard to solve it. We found that several wrong optimum results were presented in journal papers. We built a hybrid recurrent ANN to solve bi-level quadratic programming in 2014. Also we apply the system to solve real applications. We explain such research directions.

Finally we will report recent resulted of deep learning understanding of video pictures based on Masking Vision Based Autonomous Navigation.

## **SOURCE CODING AND DATA COMPRESSION**

Prof. D.S. Hooda  
Honorary Professor in Mathematics,  
G.J. University of Science and Technology, Hisar, India

In the proposed talk various encoding systems are described. The concepts of Source alphabets and Entropy are defined and their application in source coding theorem is proved. A brief account of various types and methods of data compression is given. Shannon's lossless source coding theorem and Shannon's rate distortion theory are discussed. Various types of source codes and their applications in data compression are described. In the end block Huffman codes of different orders are also discussed with examples.

# **An Overview of Domain Decomposition Method in Modelling and Simulation of Fluid Flow and Heat Transfer**

Prof. B.V. Rathish Kumar

Indian Institute of Technology, Kanpur

Domain Decomposition Method (DDM) is one of powerful strategies for solving large scale scientific and engineering problems of practical interest. Any numerical method for solving the mathematical model governing a scientific/engineering/industrial problem, which otherwise is not amenable to rigorous analytical/semi-analytical methods without several simplifications, of interest may be overlaid on this strategy to arrive at some acceptable and useful solution of interest. In this talk I will provide an overview of DDM overlaid by FEM/FVM and its ability to handle complex large scale problems on HPC platforms. Efforts will be made to give you an idea of the related mathematical theory, numerical methods together with few computational studies of industrial significance. Latest trends of ML based DEEP-DDM for PDEs with Application will also be dealt with.

## **The Ordered Weighted Average: Theory and Applications**

Prof. José M. Merigó Lindahl

University of Chile, Chile and University of Technology, Sydney

The ordered weighted average (OWA) is an aggregation operator that provides a parameterized family of operators from the minimum to the maximum. In decision analysis, it unifies the classical methods for decision making under uncertainty in the same formulation including the Laplace and the Hurwicz criteria. Thus, it is possible to establish the attitudinal character of the decision maker according to a degree of optimism or pessimism. This presentation gives a general overview of the OWA operator and some of its main generalizations including the induced OWA, the probabilistic OWA and the OWA distance. It is seen that some of the generalizations of the OWA operator includes the weighted average and some other key statistical concepts as particular cases of a more general framework. Therefore, the applicability of the OWA operator is very broad because all the previous studies that use one of these techniques can be revised with a more general formulation that considers more complex environments. But at the same time, it can be reduced to the classical approach if the available information is very simple. A general overview of decision making applications with the OWA operator is also presented.

# **COMPUTING WITH WORDS IN DECISION MAKING: ITS APPLICATION TO CLIMATE POLICY**

Prof. Martinez Lopez, Luis  
Professor of Computer Science at the University of Jaén, Spain

The concept of computing usually implies calculation processes either by mathematical means of numbers and symbols or by a computer. Paying attention to computing processes done by human beings, it is remarkable that they employ mostly words in computing and reasoning, arriving at results linguistically expressed from linguistic premises. Hence, Computing with Words (CW) applies the same view to their computing processes aiming at obtaining linguistic outcomes from linguistic inputs. Because words have fuzzy denotations when they are used by human beings, the paradigm of Computing with words was clearly stated as a branch of fuzzy logic.

The complexity of decision-making problems implies uncertainty that in many occasions has been modelled by means of linguistic information, mainly based on fuzzy based linguistic approaches. Several of these approaches have been successfully applied in decision-making to address challenges and resolve problems associated with environmental, energy, and climate policy. Therefore, it is important to point out the trends in CW and its application for climate policy for supporting policy makers together with the challenges ahead.

## **Mathematical Model of Post COVID-19 Dynamics and its Prediction**

Prof. Nita H. Shah  
Department of Mathematics, Gujarat University, Ahmedabad, Gujarat, India

With the ongoing pandemic of COVID-19 throughout the world, since December 2019, there is increasing evidence of asymptomatic individuals spreading the virus. In India, this has increased the transmission rate dramatically due to a significant number of individuals having mild symptoms. These individuals are advocated to quarantine for 14 - days whereas individuals having severe symptoms get hospitalized and get recovered if they procure proper treatment. In this talk, a fractional order model of COVID-19 scenario in India using compartmental model is exhibited. Here, the population is divided into nine compartments and set of non-linear differential equations are formulated in Caputo sense. Making use of fractional order system, we tend to show the behaviour of various population densities for different values of order of derivative  $\alpha$ . The formulated model has three equilibrium points namely- disease-free, asymptomatic free and endemic equilibria. Basic reproduction is computed for the model. After four lockdowns in India, in this study we used unlock COVID-19 data for the best fit using least curve fit method shown in numerical simulation.

# **Performance Measurements for New Business Models: The good, the bad, the ugly**

Prof. Christian A. Cancino  
University of Chile, Chile

Since 2013 the term "unicorn startup" refers to a private company valued at or more than \$1 billion dollars. In those years the statistical rarity of such a successful commercial enterprise was unlikely, but not impossible. Currently, the birth of this type of company is more and more likely, not only in the USA, but in any part of the world. In fact, today a new unicorn is born every four days. So why have unicorn startups gone from a rare breed to the new normal?

## **Finite Strains in Elastic Solids**

Prof. Sanjeev Sharma  
Jaypee Institute of Information Technology, Noida, U.P., India

Many technically important problems in elasticity including those of buckling and stability, call for a consideration of finite deformation, that is, deformations in which the displacements together with their derivative are no longer small. Theory of finite strains provides an admirable illustration of the complications that appear in the development of a theory when the fundamental equations become non-linear. To define finite deformations in a continuous medium, there are two methods, namely, the Eulerian and Lagrangian. The Eulerian mode of description is described by employing the co-ordinates of a typical particle in the strained state as independent variables and in the Lagrangian mode of description the co-ordinates of a typical particle with unstrained state are taken as independent variables. In this connection the following quotation from the paper by Seth is worth quoting: "*Like the body stress equations these (the strain components) should be referred to the actual position of a point P of the material in the strain condition, and not to the position of a point considered before strain*". Also, the elastic strains may be small but material may experience large rotations. Thus, study of finite deformation theory is very important in the field of elasticity and plasticity.

# **Evaluating Volatile Financial Markets Using Information Theoretic Measures**

Prof. H. C. Taneja

Department of Applied Mathematics

Delhi Technological University, Delhi, India

In 1948, C.E. Shannon proposed a measure of uncertainty, subsequently termed as Shannon entropy. This measure was introduced in his famous work “A Mathematical Theory of Communication”. Parametric generalizations of entropy measure have been studied by many researchers. Further, the concept of information was extended to Kullback relative information and Kerridge inaccuracy measure. In addition to communication theory, information theoretic measures have found applications in various diversified fields. Lately, entropy has been visualized as a measure of uncertainty in financial markets. In fact entropy, in some sense, has been observed as a better tool to analyze the uncertainty (volatility) in financial market data, since it observes the effect of diversification and uses more information about the probability distribution. It quantifies the regularity and diversity of price movements of a security. We explore the various situations in which different information theoretic measures can be applied to get some better insight about the financial market fluctuations and for portfolio optimizations.

## **Application of Non-Traditional optimization in solving engineering problem**

Prof. Elisabeth Amudhini

Karunya University of Technology and Sciences,

Coimbatore, India

The objective functions used in engineering optimization are complex in nature with many variables and constraints. Conventional optimization tools sometimes fail to give the global optimal points. Very popular methods like genetic algorithm, pattern search, simulated annealing, and gradient search and so on are useful methods to find global optima related to engineering problems. It attempts to use new non-traditional optimization algorithms which are used to find the minimum cost or weight or any related measures and change the designing any engineering problem to obtain global optimum solutions. The cost, number of iterations and the total elapsed time to complete the problems are all compared using these non-traditional optimization methods. The validation can be done through simulation using ANSYS.

## We Collective dynamics of Stochastic Biological Transport:

### Modeling and Simulation

Prof. Arvind Kumar Gupta

Department of Mathematics, Indian Institute of Technology Ropar,

Rupnagar, Punjab, India.

Many non-equilibrium biological processes such as intracellular transport, cellular organization, cellular motility, etc are supported by the enzymatic molecules called molecular motors/motor proteins. These motors carry vesicles ( $\geq 50$  nm) and typically move with  $\sim 5$ nm steps along microtubules. For performing the mechanical work, they convert the chemical energy derived from the hydrolysis of ATP. Similar kind of transport is also visualized in vehicular traffic.

Driven diffusive systems provide a fruitful framework for studying the statistical properties of such non equilibrium realistic processes. In the presence of driven external field, they reach a non equilibrium steady state (NESS) characterized with non-vanishing particle current. Totally asymmetric simple exclusion process (TASEP) is the minimal model for describing the unidirectional motion of particles along a lattice, where each particle occupies and covers only a single site of the lattice.

In this talk, I will try to explain how we can model the stochastic collective dynamics happening at microscopic level and understand it at macro level under both the closed and open boundary conditions. The modified version where the particles not only move along linear filaments (tracks) but also can reversibly associate/dissociate from them will also be discussed. Finally, I shall try to provide some insight about validation of the theoretical results with Monte Carlo simulations.

## DAEs: A general mathematical framework for modeling and control

Prof. Nutan Kumar Tomar

Department of Mathematics, Indian Institute of Technology Patna, Bihar, India

In the modeling of a real-world problem, the employment of various physical laws naturally yields differential and algebraic equations (DAEs) together. In contrast, reduction to only in differential equations (DEs) is complicated and sometimes not possible. Even if the conversion is possible, in the process of transforming DAEs into DEs, the system may lose some intrinsic properties. There is a growing interest in DAE systems, much depending on the increased usage of object-oriented modeling languages, such as Modelica, Spice, Simulink, Dymola, etc., in the field of control systems. Frequently, these tools yield systems in the form of DAEs. In the literature, other terms identical with DAEs are singular, generalized state space, semistate, implicit, and descriptor systems. These different terms exist due to separate investigations into such systems by researchers in various disciplines. This talk aims to explain some control-theoretic concepts for systems described by DAEs.

## **Solution of Diffusion Problems by FDM, FEM and FVM**

Prof. T. P. Singh

Pandit Deendayal Petroleum University

Gandhinagar, Gujarat, India

Numerical methods are widely used to solve diffusion problems extensively even though analytic solution is available. Diffusion problem is used in every branch of engineering and sciences. Number of numerical methods are available like finite difference method, finite element method and finite volume method etc. to get solution of diffusion problem. There are advantages and disadvantages of these numerical techniques. In this talk the solution of diffusion problem using finite difference, finite element and finite volume method is shown. A comparative analysis of solution of diffusion problem is also shown.

## **Evolution of aggregation operators and its applicability in different areas**

Prof. Ernesto Leon Castro

Universidad Católica de la Santísima Concepción, Chile.

Aggregation operators represent a set of modern techniques employed for an extensive range of purposes, including the analysis of information, economics, and engineering. These operators' goal is to join different information pieces provided by several sources to achieve a conclusion or a decision (Detyniecki et al., 2000). These operators will ensure that the decision-making process does not omit information and includes qualitative and quantitative data (Herrera & Martínez, 2000; Yu, 2015). Therefore, aggregation operators are fundamental for information fusion and are applied to combine several values into a single value (Beliakov et al., 2007; Rickard & Aisbett, 2013). These methodologies are of great use within the information analysis and decision-making processes, so they still have a wide field of work, either through traditional methods or by creating and incorporating new computational intelligence techniques. That is why knowing the leading papers, authors, procedures, and their uses will allow researchers to generate a more significant number of methodologies, improving the understanding of the different topics and decision-making processes.

# **Inception, Innovation, and Research Using Machine Learning in Diverse Areas**

Dr. Anuja Arora

IEEE Senior Member, ACM Member

Computer Science Engineering and Information Technology Department

Jaypee Institute of Information Technology, Noida, U.P. India

In the last couple of decades, a plethora of research has provided manifest that machine learning can handle diverse area issues/problems. The primary idea is to dissimilate knowledge of machine learning usage and exposure in diverse areas. A lot of researchers have applied machine learning algorithms and techniques in order to resolve issues such as physical object detection, trajectory prediction, tumor prediction, orthopedic surgery, social media marketing, advertisements, Information diffusion, Recommendation systems, etc. The current and on-going research towards machine learning is laying a solid foundation for the research of diverse areas as a diagnostic tool. Traditional experiments and computational techniques often consume tremendous time and resources. Thus, it is imperative to develop an innovative machine learning-based model to accelerate the research outcome performance. Recently, machine learning has been receiving increasing attention and has achieved great improvements by enhancing efficiency and accuracy in diverse area research problems.

## **Artificial Intelligence in fight against COVID-19**

Dr. Sachin Sharma

Institute of Advanced Research, Gandhinagar, Gujarat, India

As the whole world is witnessing what novel coronavirus (COVID-19) can do to the mankind, it presents several unique features also. Till today there is a global shortage of testing labs and testing kits for COVID-19. This presentation discusses about the role of Artificial Intelligence techniques for getting important insights like whether lung computed tomography (CT) scan can be used for detection of COVID-19 or not?

# **Metric Fixed-Point Theory: Generalization and Applications**

Prof. Bhagwati Prasad Chamola

Department of Mathematics, Jaypee Institute of Information Technology, Noida

The domain of the metric fixed point has been widely studied and explored in the literature of nonlinear analysis. The theory of fixed points and iterated function systems has evolved its potential applications in the areas of image compression, encryption, computer graphics, chaos and fractals, simulation and modeling and other domains of sciences and engineering. The intent of this talk is to present an overview of the recent advances of metric fixed-point theory, its important generalizations and their subsequent applications in diverse domains of knowledge.

## **Abstracts of Contributory Talks**

**SNOV-DNOV Mesh Sorting for Multi-Objective Optimization**

<sup>1</sup>Rupande Desai, <sup>2</sup>Narendra Patel

<sup>1</sup>L. D. College of Engineering, Ahmedabad

<sup>2</sup>Government Engineering College, Valsad

**Abstract.** A single parameter based sorting algorithm is proposed for the survival and fitness selection in population based multi-objective evolutionary optimization algorithms. The proposed algorithm is working based on Summation of Normalized Objective Vector (SNOV) and Difference of Normalized Objective Vector (DNOV). The SNOV-DNOV sorting is having computational complexity of  $O(m3.5N)$  as compared to  $O(mN^2)$  by non-dominated sorting. The proposed algorithm as compared to non-dominated sorting eliminates the classification of the population into non-dominated fronts and calculating crowding distance. The proposed one parameter approach provides flexibility of choosing any probability based selection operator. Theoretical analysis and empirical results both show that the proposed algorithm is computationally efficient in sorting the population. The proposed sorting mechanism is not limited to any specific evolutionary algorithm and be used with any population based multi objective optimization algorithm for sorting the population. The computational performance of the proposed SNOV-DNOV sort algorithm is compared with the conventional Non-dominated sorting, and a fast corner sort algorithm. The performance of all the three sorting approaches (SNOV-DNOV sorting, Non-dominated sorting, and corner sort) is presented for its computational effectiveness with respect to population size, number of objective functions, and distribution of population.

**Keywords:** Multi-objective sorting, SNOV sort, Non-dominated sorting, corner sort, mesh sort.

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**Signature Analysis of Series-Parallel System**

<sup>1</sup>Akshay Kumar, <sup>2</sup>Mangay Ram, <sup>3</sup>Soni Bisht, <sup>2</sup>Nupur Goyal, <sup>4</sup>Vijay Kumar

<sup>1</sup>Graphic Era Hill University, Uttarakhand, India

<sup>2</sup>Graphic Era (Deemed to be University), Uttarakhand, India

<sup>3</sup>Eternal University, Baru Sahib, Himachal Pradesh, India

<sup>4</sup>AIAS, Amity University, Noida, India

**Abstract.** This paper explores the idea of complex system having components in the form of series- parallel combination. Authors extend the idea of general law of addition of probabilities. They use this idea in the system of components having conditional mutual independent events. In this current study, the authors use the concept of general law of addition of probabilities to

find the reliability and signature of components. To demonstrate this idea a numerical example has been taken to discussed the proposed techniques.

**Keywords:** Reliability; Independent events; Conditional probability; Signature; Series-Parallel system.

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## MMCITRE2021 - 004

### Computational Reconstruction of Gene Regulatory Networks using Half-Systems incorporating False Positive Reduction Techniques

Prianka Dey<sup>1</sup>, Abhinandan Khan<sup>2</sup>, Goutam Saha<sup>3</sup>, Rajat Kumar Pal<sup>2</sup>

<sup>1</sup>Future Institute of Engineering and Management Sonarpur Station Road, Kolkata, India

<sup>2</sup>University of Calcutta, Acharya Prafulla Chandra Roy Shiksha Prangan, Kolkata, India

Princeton University, Princeton, USA

<sup>3</sup>North-Eastern Hill University, Shillong, India

**Abstract.** All biological activities in living organisms are controlled by the regulatory interactions among the genes and this interaction can be represented by Gene regulatory networks. Remodelling of such networks from time-series gene expression datasets is an incredibly intriguing task, and a biologically accurate reconstruction is yet to be achieved. Also, existing computational methods predict a significant number of false positives. Here, we have posed a technique for the reduction of false positives by bringing together two metaheuristic techniques. A hybrid swarm intelligence technique has been proposed based on artificial bee colony optimisation and dragonfly algorithm. We have used half-systems for modelling the network dynamics. The stated methodology has been applied on real-world experimental datasets of the SOS DNA Repair network of Escherichia coli and a 10-gene in silico DREAM3 Challenge network. The acquired results show that the posed methodology can reduce the false positives of the predicted network to a considerable extent.

**Keywords:** Artificial bee colony, Dragonfly algorithm, False positives, Gene regulatory network, Half-system, Reverse engineering.

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**Cryptanalysis of Fuzzy Based Mobile Lightweight Protocol Scheme**

Nishant Doshi

Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India

**Abstract.** With the advancement of technology evolution in this 21st century, the use of mobile devices also increased with a rapid growth. Due to pluses of mobile devices like lightweight, mobility, features on day-to-day routines makes it a handy choice for today's society. With the increasing use of the mobile technology, need of securing the data which were communicated among the devices become prevalent factor for research. Among various technologies for achieving the data security, the authentication protocol is more suitable due to provide authentication in addition to data security. The authentication protocol is broadly classified into three categories i.e., one factor (identity), two factor (identity, text password) and three factors (identity, text password, fuzzy biometric password). Among these, the three factor is widely used due to more secure as to others. Recently, Qiu et al. in 2020 proposed the authentication scheme using three factors for the mobile lightweight devices and claimed to be secure against various attacks. However, in this paper we prove that the Qiu et al.'s scheme yet susceptible to the attacks like replay, session specific temporary information, denial of service and stolen verifier. In addition, the Qiu et al.'s scheme yields overhead as to other conventional three factor schemes.

**Keywords:** Three Factor, Fuzzy, Authentication, Mobile Lightweight Device, Attacks.

**Performance Analysis of Nonlinear Isothermal CSTR for it's different operating conditions by Sliding Mode Controller design**

N.S. Patil, B.J. Parvat

Maratha Vidya Prasarak Samaj's Karmaveer Adv. Baburao Ganpatrao Thakare College of Engineering, Nashik, India

**Abstract.** This paper presents, control performance analysis of nonlinear isothermal continuous stirred tank reactor (CSTR) by design of sliding mode controller (SMC) for it's different operating conditions. An isothermal CSTR is a benchmark example of nonlinear chemical process which produces inverse response; hence it is difficult to control by use of traditional controllers. In this work, inverse response, negative response and maximum yield point operating conditions obtained from steady state characteristics of CSTR are considered for design of sliding mode controller. For sliding mode controller design, an extended state

observer is used which estimates uncertainties and nonlinearities present in CSTR. After successful design of SMC for above mentioned three operating conditions, its simulation results are obtained. The comparative control performance analysis of obtained results is done on the basis of error indices and is presented here in the paper.

**Keywords:** Sliding mode control, Advanced control, Isothermal CSTR, Non-linear process.

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## **MMCITRE2021 - 008**

### **Tuning $P_{\max}$ in RED gateways for QoS Enhancement in Wireless Packet Switching Networks**

N. G. Goudru

Nitte Meenakshi Institute of Technology, Bangalore, India

**Abstract.** In wireless packet switching networks, Random Early Detection (RED) gateways are used for congestion avoidance. By computing an average queue length of the bottleneck link, the RED gateway detects the incipient congestion. The RED gateways notify the congestion formation to the source TCP connections either by setting a bit in the acknowledgement packet header or by dropping the incoming packets with a certain probability. Through this means RED gateways tries to keep the average queue length below the maximum threshold value. Tuning RED parameters is a challenging task for network engineers. In this paper, we tried to estimate a stable boundary for  $P_{\max}$ . We use stochastic models representing sender window dynamics, average queue length and packet dropping probability. The non-linear equations have been linearized using transformation technique. By constructing Hermite matrix for time-delay control system, analysis has been made to determine a stable boundary for  $P_{\max}$ . The performance of sender window, queue length, packet dropping probability and throughput has been analyzed using statistical data and graphs obtained by MATLAB programming. The results revels that the queue length, sender window size, and random packet dropping probability converge to smaller range over their values. A comparative study has been made by conducting experiments for assumed  $P_{\max}$  value (0.05) and for stable  $P_{\max}$  value. Application of stable  $P_{\max}$  value gives an excellent throughput and better network performance.

**Keywords:** Bottleneck link, Cwnd, Packet dropping, Queue length, RED gateway, Stability, TCP, RTT.

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**Development of 2D Axisymmetric Acoustic Transient and CFD based Erosion Model for Vibro Cleaner using COMSOL Multiphysics**

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**Abstract.** In cleaning industries, Vibro Cleaner has been used to remove contamination like dust, dirt, oil etc. from out of reach or critical surfaces of the objects. This process is completely safe for human as well as eco-friendly. The purpose of this study is to introduce pressure acoustic transient model for vibro cleaner by using COMSOL Multiphysics software. By COMSOL Multiphysics, Acoustic and CFD approaches have been coupled to gather to achieve great results in sound pressure level, acoustic pressure, velocity of fluid flow, particle trajectory and erosion rate. Piezoelectric transducer has been used to generate pressure waves in liquid media by converting electric energy into mechanical vibration through tank wall transience. Due to pressure difference in liquid, cavitation bubbles have been produced which creates turbulence in acoustic streaming fluid flow and can be studied by using bubbly flow module. Also, Particle tracing module and finnie erosion module have been used to understand the particle trajectory and erosion phenomenon. Various frequencies like 28 kHz and 40 kHz have been used to evaluate the performance of various parameters. Here, PZT-4 piezoelectric transducer has been used to get more pressure generating rates as well as reduces the cleaning time.

**Keywords:** Pressure Acoustic Transient, Pressure waves, Cavitation effect, Piezoelectric transducer, Erosion rate, COMSOL Multiphysics.

**Ces`aro -Riesz Product Summability  $\varphi - |C_1 R|_q$**

**Factor for an Infinite series**

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**Abstract.** In this paper, absolute Ces`aro-Riesz summability  $\varphi - |C_1 R|_q$  for infinite series has been introduced and a generalized theorem has been determined for  $\varphi - |C_1 R; \delta|_q$  summability factor for Pan $\lambda_n$ . Further, a set of corollaries has been developed from the main result by using appropriate conditions. Summability techniques are used to reduce inaccuracy. By using the appropriate conditions previous results can be easily obtained. Like this, the Bounded Input

Bounded Output (BIBO) stoutness of drive is enhanced by absolute summability because it is necessary and sufficient condition for BIBO stability.

**Keywords:** Minkowski's inequality, Ces`aro-Riesz mean, H'older's inequality, Abel's Transform, Absolute summability.

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## **MMCITRE2021 - 014**

### **Computation Analysis of single point cutting tool with different shim Materials**

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**Abstract.** Very high speed of machine tool inducing higher vibration in cutting operation. In this paper, a passive damping control system has been explored by computational analysis to reduce vibration in the turning process by inserting different shim materials beneath the insert. The different shim materials of carbide, aluminum, brass, and S.S are compared through computational analysis. In this canalysis of different shim, materials have evaluated a harmonic response and damping ratio. The damping ratio has been derived by half power band theory. This research work is lead to conclude that harmonic response analysis and half power band theory accomplish that single point cutting tool with S.S shim is more effective to reduce vibration.

**Keywords:** Chatter, Shim materials, Harmonic analysis, Passive damping.

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## **MMCITRE2021 - 017**

### **Optimize Feature Selection for Condition based monitoring of Cylindrical bearing using Wavelet transform and ANN**

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**Abstract.** This paper presents the fault diagnosis methodology based on the advanced signal processing technique along with the data mining method. Wavelet analysis defines the basic mathematical function of the vibration signal by comparing it with the pre-defined wavelet. After analyzing the signals with the use of the wavelet concept, Data acquisition helps in the detection of the bearing defects. This paper presents the effective selection of the attributes of

signal for data mining methods. Training of the data in the Artificial neural network using different algorithms and with the various combinations gives different results. The result for the Cylindrical bearing with four conditions shows that out of twelve different features, the best result 97.6 % is coming in the combination of the top ten ranked features. Advance method of ranking the features according to their accuracy in the ANN is adopted and combination of top ranked features is shown better results in comparison with the conventional methodology. The experimental setup gives the time-frequency data for four bearing conditions such as healthy bearing, bearing with outer race defects, bearing with inner race defect, and bearing with ball defect. Result proves that the proposed method is having its advantage for the faults diagnosis of the cylindrical bearing with the most effective feature selection method.

**Keywords:** Cylindrical Bearing, Fault Diagnosis, Statistical feature, Feature Selection, ANN, Signal Processing, Wavelet Transformation.

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## MMCITRE2021 - 019

### Energetic and Exergetic Analyses of Hybrid Wind-Solar Energy Systems

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**Abstract.** The energetic analysis of system gives a clear indication of the system performance. However, in order to attain an accurate idea about the actual potential of the energy conversion and the regimes to be focused on performance improvement, the exergetic analysis is an important and necessary tool. The present study encompasses both energy and exergy analyses on the hybrid wind-solar energy systems (HWSES). The study presents that hybridizing the energy systems would reduce the energy efficiency variations over the month and ensures mean efficiency above 15% throughout the year. Moreover, the addition of a solar energy system to the existing wind energy system enhances the overall exergy efficiency while achieving a peak value of over 10 % without falling below 5% over the year. Hence, HWSES have superior performance than the standalone systems in terms of energetic and exergetic performance.

**Keywords:** Wind energy, Solar Energy, Hybrid Energy, Energy Analysis, Exergy Analysis.

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**PSO Based PFC Cuk Converter Fed BLDC Motor Drive  
for Automotive Applications**

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**Abstract.** This paper presents a method for the powerfactor correction of Brushless DC motor (BLDC) drive by utilizing the Cuk converter with Particle Swarm Optimization (PSO) controller. This drive can be used for very low cost and less power applications. The Brushless DC motor speed was controlled by changing the DC bus voltage of Voltage Source Inverter (VSI) for minimal switching losses. The Cuk converter works with both discontinuous conduction method and continuous conduction method though the diode bridge rectifier was followed behind it for changing the DC link voltage. This improves the power factor at AC mains of the circuit. The PSO controller is employed for getting the various best values of measurements by comparing process. The suggested system is simulated by using MATLAB/Simulink software and a hardware prototype model of this suggested drive was made to authenticate its performance over a broad range of speed with better powerfactor at AC mains of the circuit.

**Keywords:** Powerfactor, Optimization, Rectifier, Hardware, PSO.

**A Note on Solution of Linear Partial Differential Equations  
with variable coefficients formed by Algebraic Function  
using Sumudu Transform with  $S_m$  operator**

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**Abstract.** A different approach to solve initial value problems form by algebraic functions (homogeneous and non-homogeneous functions) using Sumudu transform is given in this article. Two dimensional  $S_m$  operator with two variable Sumudu transform is well defined and its existence is proved, the duality relations with other transforms and Sumudu transform with  $S_m$  operator are proved in the given article.

**Keywords:** Laplace Transform, Sumudu Transform,  $S_m$  operator, PDE with variable coefficients.

**Role of Fractional Order Convexity in Nonlinear Programming Problems**

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**Abstract.** A wide range application of fractional order calculus is seen in science and engineering, statistics, economics and modeling of many real-world phenomena. Especially convexity plays a vital role in optimization programming problems. A lot of real-life problems still exist, which require the refinement of the definition of convexity. Therefore, we tried to introduce convexity with respect to Caputo fractional derivative applied in general nonlinear programming problems. In particular, developed the Karush-Kuhn-Tucker conditions and proved the sufficient optimality conditions. Several consequences of the fresh findings are discussed. Suitable numerical examples are given to validate the obtained results.

**Keywords:** Caputo fractional derivative, Convexity, Karush Kuhn Tucker conditions, Sufficient optimality.

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**SafeShop: An integrated system for safe pickup of items during COVID-19**

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**Abstract.** It's almost a year since COVID-19 took a toll on the world. While there is no cure found for the same, safety measures and precautions are taken to ensure the containment of the virus. Wearing a mask and ensuring social distancing has become of utmost importance. Due to the lack of ensuring a safe method to reopen, businesses have suffered a lot. SafeShop is an integrated system made on the two main pillars of containing the virus- social distancing and wearing a mask. The camera feed at the entrance of the shops takes a snapshot of the person entering the shop which is then passed on to the backend of our machine learning algorithm which permits the person to enter only if he/she is wearing the mask correctly. The location of everyone in the enclosed space is constantly fetched and the distance is calculated based on it and displayed as a graph to everyone to ensure proper social distancing. We have achieved an accuracy of 94.67% in our Face Mask detection model and our social distancing algorithm constantly fetches the location to ensure safety all the time. SafeShop ensures that all the shops can re-open safely and the people visiting these shops also feel safe. We exploit the recent development in technologies to build a fully integrated system.

**Keywords:** COVID-19, Social Distancing, Face Mask Detection, Machine Learning, SafeShop.

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## **MMCITRE2021 - 024**

### **Motions of a Freely Floating Thick Rigid Structure over Asymmetric Trenches**

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**Abstract.** The present study analyzes the motions of freely floating rigid structures over the asymmetric trenches. The boundary value problem (BVP) is solved using the boundary element method (BEM). Various physical parameters such as radiation damping and added mass associated with the surge, heave and pitch motions of the freely floating body over the asymmetric trenches are studied for various values of dock length. The study shows that the damping coefficient and added mass correspond to the heave and pitch motions of the rigid dock increases with an increase in dock length. In addition, the added mass and damping coefficient related to the surge motion of the floating dock increases with an increase in dock length in the long wave regime. Nevertheless, reverse pattern is noticed in the intermediate wave regime. Moreover, there is no significant effect of dock length on the damping coefficient and added mass correspond to surge motion in the short-wave regime.

**Keywords:** Radiation, Boundary element method, Heave, Surge, Pitch.

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## **MMCITRE2021 - 025**

### **Multivariate Analysis and Human Health Risk Assessment of Groundwater in Amreli District of Gujarat State, India**

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**Abstract.** Principal Component Analysis (PCA) and Hierarchical Cluster Analysis (HCA) techniques are used to understand the groundwater quality parameters of Amreli district. As many chemical species are in dissolved form in the groundwater, multivariate analysis helps in identifying the important factors/components. HCA is performed on a dataset of thirty-four

samples by using Ward's method. Furthermore, human health risk assessment is carried out for various chemical species present in the groundwater of Amreli district by computing the chronic daily intake (CDI) and hazard quotient (HQ). Results reveal that there is a high correlation between Na-Cl (0.94), Na-SO<sub>4</sub> (0.8), K-Cl (0.799) and moderate correlation for Na-HCO<sub>3</sub> (0.69) and Ca-SO<sub>4</sub> (0.63) while a negative correlation of (-0.18) between F-Ca. A three-factor model gives a total variance of 81.78 percent PCA shows very high factor loading for sodium (0.97), potassium (0.78), bicarbonates (0.66), chlorides (0.93) and sulphates (0.83) and EC (0.96). Hierarchical agglomerative cluster analysis gives two clusters of chemical species. Results show that the mean chronic daily intake values for anions Cl >NO<sub>3</sub>>F and for cations Ca >Mg>K. The mean hazard quotient values for anions Cl >NO<sub>3</sub>>F and for cations K >Mg>Ca.

**Keywords:** Principal Component Analysis, Hierarchical Cluster Analysis, Chronic Daily Intake, Hazard Quotient.

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## MMCITRE2021 - 026

### CBSSE-IoT: A Clue-Based Services Search Engine for the Internet of Things

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**Abstract.** Internet of Things is the evolution of the combination of smart objects that gathers and communicates information on the surroundings thereby making the ecosystem a smart environment. The major issue in the IoT environment is that there is a huge variety of objects manufactured by various vendors and intended for numerous purposes. There is a need for a novel middleware-based framework to maintain a directory of files describing the characteristics of the devices and the services provided by these devices. Our proposed approach represents a framework that maintains the directory of the files describing the services provided by the registered objects in the IoT environment.

**Keywords:** Internet of Things (IoT), Middleware, Directory.

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**Free axisymmetric vibration of thick circular sandwich plates  
using a higher-order theory**

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**Abstract.** Reddy's third-order theory is adopted to analyze the free axisymmetric vibrations of thick circular sandwich plates with a relatively stiff uniform core and membrane facings. Hamilton's principle is used to develop the equations of motion and natural boundary conditions. Numerical solution for frequency equations of simply-supported, clamped and free edged plates are obtained using Chebyshev collocation method. The least three roots obtained are reported as the natural frequency parameters for the first three vibration modes. Validation of the results presented in the paper is done by making comparison with their counterparts accessible in available published works. Results are exhibited numerically and graphically to study the influence of thicknesses of the core and facings on the natural frequencies. The significance of the proposed model is established by showing that for the estimation of natural frequencies of thick cored circular sandwich plates, previously published models based on first-order theory are not sufficient.

**Keywords:** Circular sandwich plates, Axisymmetric vibrations, Hamilton's principle, Chebyshev collocation technique, Reddy's Theory.

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**Association Schemes over some finite Group Rings**

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**Abstract.** In this paper, we study non symmetric commutative association schemes for cyclic groups  $\mathbb{Z}_p \times \mathbb{Z}_p \times \dots \times \mathbb{Z}_p$  | r times ( $p$  is prime),  $\mathbb{Z}_{p_1} \times \mathbb{Z}_{p_2} \times \dots \times \mathbb{Z}_{p_r}$  ( $p_i$ s are distinct primes), dihedral group and symmetric group without using conjugacy classes. We also construct commutative association schemes for finite group rings over  $\mathbb{Z}_n$ , the ring of integers mod  $n$ . Moreover, we construct association scheme for  $n \times n$  circulant matrices over  $\mathbb{Z}_p$ , for  $p$  prime.

**Keywords:** Group ring, Association Scheme, Symmetric group, Dihedral group, Circulant Matrices.

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**Multi-layer Encryption Algorithm for Data Integrity in Cloud Computing**

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Tareq Al-shaikh, Mohammed Ghazi Al-Khaiyat

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**Abstract.** The Internet revolution has changed all aspects of our life, accessing and surfing the Internet is becoming as necessity in our life to obtain any kind of information needed, and that produces a huge quantity of data available anytime, anywhere. The greater the facilities, less is our data privacy. For that maintaining data confidentiality and integrity in the Internet and cloud world is a primary requirement to continue working and using these facilities. In this paper, we propose a security mechanism that makes accessing the data from unauthorized persons more complex. Our mechanism easy to implement and understand, it works in three levels in each level is used a new encryption key generated randomly and in each level is used a different encryption algorithm. Our results show that the encryption/decryption process time is increased linearly with the text size for the authorized persons and is increased exponentially for unauthorized persons.

**Keywords:** Symmetric Encryption, Three Tier Architecture, Data Confidentiality, Data Integrity, Homomorphic Encryption.

**Stability and Convergence of Implicit Finite Difference Scheme for Bioheat****Transfer Equation with Clothing Effect in Human Thermal Comfort**

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**Abstract.** This paper studies the stability and convergence of implicit Finite Difference (FD) scheme of the bioheat transfer model of Pennes' type with the clothing effect at the boundary node. Robin's boundary condition, in this study, incorporates the clothing insulation, effective clothing area factor in the combined heat transfer coefficient and observes their effects for the thermal comfort in the human body. Lemma and theorems for consistency, stability and convergence of FD scheme are established and the numerical results are graphically presented for validation of the model.

**Keywords:** Bioheat Transfer, Clothing Effect, Finite Difference (FD) Scheme, Effective Clothing Area Factor.

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## **MMCITRE2021 – 033**

### **Postulated failure analyses of tension leg platform (TLP) restraining system under the influence of varying sea-state conditions**

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**Abstract.** Increase in energy demand has led to an increase in hydrocarbon exploration and production in deep water environments. Tension Leg Platform (TLP) are taut moored floating type structures that are operational in deep-water environments. The restraining system, which is a taut moored tether, forms a critical component of the TLP. Tethers that are held at a high pretension and is subjected to continuous variation in stress due to the dynamic loads in the ocean environment. The dynamic loads due to the continuous stress reversals cause fatigue. It is essential to analyze the fatigue life of such structures during the design phase. Tether pull-out can occur in the case of any undesirable loads acting on the restraining system. The present study focuses on determining the fatigue life of the tether under normal operating conditions by employing rain-flow counting and Miner's rule. Also, fatigue life analysis is accomplished by considering the postulated failure condition in the restraining system wherein one tether is failed in each of the four legs. It is observed that there is a substantial reduction in the fatigue life for the postulated failure condition. In the phenomenal sea-state condition, the fatigue life of tether reduces by 97% as compared with the fatigue life in normal operating conditions.

**Keywords:** Offshore engineering; Tension Leg Platform (TLP); Tethers; Miner's rule; Rain-flow counting.

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**Dynamic analyses of a tension leg platform (TLP) under very rough sea-state**

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**Abstract.** In order to minimize the risk as well as cost in offshore deep-water activities, development of several floating offshore platforms have taken place. Being the most widely employed platform for deep-water operations, the performance of a Tension Leg Platform (TLP) is remarkable in terms of its motion under the influence of waves. Dynamic analysis has a key role in the evaluation process of the performance of these platforms in offshore environment. This study focuses on the dynamic numerical analysis of the International Ship and Offshore Structures Congress (ISSC) TLP platform in irregular waves under very rough sea-state using Pierson – Moskowitz (PM) spectrum. The impact of coupling between two degrees of freedom (DOF) of TLP motion, surge, and heave, is a significant problem with regard to its structural response. Hence, the motion of the TLP in these two DOF are considered in the presented study. The TLP's natural periods are computed and validated. From engineering design and response analysis perspective, current study will be useful for offshore engineers to acquire deeper insights into the structural response of TLP.

**Keywords:** Deep-water, dynamic response, Pierson – Moskowitz (PM) spectrum, offshore platforms, Tension Leg Platform (TLP).

**Anomaly detection using class of supervised  
and unsupervised learning algorithms**

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**Abstract.** Anomaly detection, a concept that has been studied for many decades now, and many literature, frameworks, and algorithms are proposed after that. As intrusion can occur in any scenario, and to identify one precisely becomes a vital role. The reverberation of not detecting these outliers can be severe and can result in a huge loss. In this paper, we concentrate on identifying an anomaly using supervised and unsupervised learning techniques for instance Support Vector Machines (SVM), Artificial Neural Network (ANN), Long Short-Term Memory Recurrent Neural Network (LSTM-RNN), Isolation Forest, and K-Means clustering algorithm.

Four real-world open-source datasets are studied for this purpose and a statistical method known as the adaptive threshold is utilized for the detection of anomalous data points in these datasets. Several regression metrics are obtained for the datasets and anomalies corresponding to these datasets are compared with unsupervised learning algorithms.

**Keywords:** Anomaly Detection, Support Vector Machines (SVM), Artificial Neural Network (ANN), Long Short-Term Memory Recurrent Neural Network (LSTM RNN), Isolation Forest, K-Means Clustering.

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## MMCITRE2021 – 036

### Fuzzy model of transmission dynamics of Covid-19 in Nepal

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**Abstract.** Corona virus disease is an infectious viral disease threatening the world. It was first found in China, in December 2019, and it has been spreading in more than 210 countries. The heterogeneity of the transmission of the disease should be considered to formulate the model of the disease dynamics. Deterministic models assume constant recovery rate and transmission rate of the disease that are inconsistent with reality. Using fuzzy theory, the heterogeneity and uncertainty on the disease transmission can be described. In the present work, we study the dynamics of transmission of COVID-19 with fuzzy SAIHR compartmental model. We consider asymptomatic and symptomatic infected compartments. Also, we calculate the basic reproduction number  $R_0$ , fuzzy basic reproduction  $R_0^f$  and describe the relation between them with different virus loads. Simulation are made to study results of the model graphically.

**Keywords:** COVID-19, Fuzzy Compartmental Model, Fuzzy Basic Reproduction Number, Asymptomatic Infected, Symptomatic Infected.

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**Multi-Objective Optimization of Superstructure for  
Biodiesel Production from Biomass**

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**Abstract.** Biodiesel is composed of a long-chain of fatty acid that is extracted from lipid containing biomass or feedstock. It is termed a complex task to produce biodiesel from the feedstock. There is a need to optimize the production process to make it a cost-effective method to produce biodiesel. In this research work, superstructure optimization is performed by the Multi-Objective Optimization Algorithm. The optimization will result in a determination of optimal production of output with specified input raw material. The proposed model will be designed with an objective function to minimize the processing costs, maximize catalyst produced, maximize end products, and maximize overall profit.

**Keywords:** Biomass, Biodiesel Production, Superstructure, Optimization, Multiple objective functions.

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**FUZZY BETA C-OPEN SETS**

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**Abstract.** Fuzzy beta open sets are generalized using fuzzy C-open sets and some of their properties are investigated. Further fuzzy beta interior and closure are studied using fuzzy C-interior and their properties are discussed.

**Keywords:** Fuzzy complement, Fuzzy C-open sets, Fuzzy beta C-open sets.

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**On intuitionistic fuzzy measures of generalized bounded variation**

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**Abstract.** In this paper, we introduce a generalization of the total variation called total *Ap*-variation for fuzzy measures and show that the collection of fuzzy measures of bounded *Ap*-variation forms a Banach algebra. Further, we define the term intuitionistic non-monotonic fuzzy measure and apply this concept of total *Ap*-variation to intuitionistic fuzzy measures and prove that the collection of non-monotonic intuitionistic fuzzy measures with bounded *Ap*-variation also forms a Banach algebra.

**Key Words:** Fuzzy measure, Intuitionistic fuzzy measure, Bounded variation, Banach algebra.

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**Water wave trapping by floating L-shaped porous breakwater**

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**Abstract.** A BEM based numerical model is presented to investigate the water wave trapping by a floating L-shaped porous breakwater using small amplitude wave theory. The flow through the permeable medium is analyzed using the Sollitt and Cross model. The efficiency of the breakwater system is analyzed by evaluating the reflection coefficient for a broad variety of structural and wave parameters. This study illustrates that the wave reflection is more in the long-wave regime and less in the short-wave regime for larger values of the structural porosity. Also noticed that the minimum wave reflection is obtained in presence of porous breakwater having 35% porosity with relative width = 2.0.

**Keywords:** Wave trapping, Integral equation, BEM, reflection coefficient.

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**Analysis of State of Health Estimation for Lithium ion Cell using Unscented and Extended Kalman Filter**

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**Abstract.** There is tremendous potential for the growth of electric vehicles (EVs) in near future. Hence, investigations on different aspects of propulsion system, battery management and charging infrastructure are focused upon by academic and industrial researchers. Battery Management Systems (BMS) are responsible to estimate battery parameters and protection. Precise estimation of the State of Charge (SoC) and State of Health (SoH) is crucial functionality of the BMS. Such estimation can inform the driver about the remaining range, replacement of battery pack in their vehicle, and the charging requirements. SoC and SoH estimation necessitates a reliable model for battery. This paper provides a comparative study of the SoH and SoC assessment of Lithium-ion cells with the help of Extended Kalman Filter (EKF) and Unscented Kalman Filter (UKF). Different factors such as temperature and variations in internal resistance are considered in the simulation studies. Important methods for estimation of SoH and SoC are reviewed. An Equivalent Circuit Model with 3-RC branch is used in analyses, to simulate lithium-ion cell. The rise in internal resistance of lithium ion-cell as a consequence of charging and discharging is analyzed and the resulting degradation is studied using UKF and EKF.

**Keywords:** Extended Kalman Filter, Unscented Kalman Filter, State of Charge, State of Health, Lithium-ion Battery.

**Strongly prime radicals and S-primary ideals in POSets**

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**Abstract.** In this paper, the theory of the strongly prime radical of an ideal in posets is defined. Also we studied the notion of S-primary ideals. Characterization of S-primary ideals with respect to strongly prime radical are discussed. Further, S-primary decomposition of an ideal is obtained.

**Keywords:** POSets, ideals, strongly prime ideal, strongly m-system, strongly prime radical, S – primary.

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**Shape preserving Hermite interpolation reproducing Ellipse**

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**Abstract.** In this paper, trigonometric splines are used for Hermite interpolation of the data consist of functional values and their derivatives. If the derivative data is given then we reparameterize the data suitably. Otherwise, we find them using a necessary and sufficient condition. We show that our Hermite interpolant preserves the monotonicity. We introduce the notion of  $T$ -convex and show that convexity of  $T$ -convex data is preserved by our Hermite interpolant. The biggest advantage of our method is that it reproduces ellipse. We also provide some numerical examples to validate our theory.

**Keywords:** Hermite interpolation, Quadratic trigonometric spline, Shape preservation, Ellipse.

**Improving Support Vector Machine accuracy with  
Shogun's multiple kernel learning**

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**Abstract.** A traditional kernel-based classifier only uses a single kernel, but the real-world implementations have stressed the need to acknowledge a combination of different kernels, widely known as multiple kernels. To improve the accuracy of the classification, multiple kernel learning should be applied. In this paper, we apply an experimental combination of Gaussian and Polynomial kernel on a simple dataset in the form of an XOR gate that uses the logical\_or function from NumPy and observes how much the combination tunes the prediction accuracy. To achieve this purpose, the Shogun Machine Learning Toolbox's help with a python interface and SVMLight as an SVM solver is taken. The experimental SVM-MK shows that the proposed combination of kernels provides a better accuracy to the prediction of binary output.

**Keywords:** SVM, Kernel function Classification, Multiple kernel learning, SHOGUN toolbox, SVMLight.

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**Feedforward Backpropagation Neural Network Based Passive Fault Tolerant Control for SISO Uncertain System**

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**Abstract.** This finding concurs with fault-tolerant control optimized for an uncertain SISO level control framework that used a feed-forward neural backpropagation network. In chemical, food processing, cement or other engineering industries level control system is a very important and frequently used. In the closed loop control system performance of the system mainly depends on actuator and sensor. Numerous problems and issues in SISO level control system functions are related to actuator or system part failures. Therefore, malfunction occurring into actuator, sensor or system component leads to performance degradation and into instability region. Thus, fault-tolerant control of a SISO level control system is inseparably related to the tolerance of the actuator and system component faults. In this study, the passive fault-tolerant control approach suggested employing feed-forward neural backpropagation networks. This article subsequently presents simulation results of the proposed approach to the SISO Uncertain Level Control System against Actuator and System Component Defects.

**Keywords:** Actuator fault, system component fault, SISO uncertain system, passive fault tolerant control, neural network.

**Optimal Mild Solutions of Time-Fractional Stochastic Navier-Stokes Equation with Rosenblatt Process in Hilbert Space**

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**Abstract.** The aim of this manuscript is to establish the optimal mild solutions of time-fractional stochastic Navier-Stokes equation governed by the Rosenblatt process. The basic deterministic nonlinear time-fractional partial differential system is enriched with a stochastic term. The solvability is discussed with the help of stochastic analysis, fractional calculus, fixed point theorem of condensing maps, and by establishing an appropriate measure of non-compactness. Further, an optimal mild solution is established.

**Keywords:** Existence of mild solutions, Hilbert space, Measure of noncompactness, Optimal mild solutions, Rosenblatt process, Time-fractional Navier-Stokes equation.

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## MMCITRE2021 - 052

### **A Statistical Analysis of Life Expectancy across South Asian Countries with Special Reference to India: 1980 – 2015**

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**Abstract.** South Asia covers about 5.1 million km<sup>2</sup>, which is 3.4% of the world's land surface area and accommodates about one fourth of the world's population. This area has a quarter of the world's population, weak public sector health care, and a staggering disease burden, and thus research is particularly important. Life expectancy at birth is considered as one of the most widely used health indicators in a country. It is referred to as the number of years which a group of persons beginning life together expected to live on the average. This paper seeks to make a comparative study among South Asian countries with respect to Life expectancy at birth. It also tries to examine the Influence of some socio-economic and demographic factors in driving Life expectancy. Secondary data have been collected from World Health Organization, World Development Indicators, World Bank. ANOVA technique has been used to see any significant difference in LE among selected countries. Moreover, Linear Regression is being used to explore determinants of LE. Data are log transformed to check for heteroscedasticity. Finally, we conclude that the study has established statistical differences among the South Asian countries in terms of LEB. Moreover, results of regression analysis have identified certain determinants of LEB.

**Keywords:** Life Expectancy at birth, ANOVA, Multiple Linear Regression, South Asian Countries.

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## **Comparative Analysis of Gilled Mushroom Edibility Prediction using Dimensionality Reduction and Machine Learning Methods**

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**Abstract.** Picking mushrooms, also known as shrooming is one of the widespread occupations during the autumn season. Mushroom prediction models for distinguishing between edible and poisonous mushrooms are not yet available widely. This paper draws attention to the mushroom edibility prediction of gilled mushrooms based on various objectives like odor, cap color of the mushroom, and habitat. It consists of different prediction sets, one with all the features required for the prediction, and the other with the selected features by using different correlation matrices. It employs various classification techniques such as Logistic Regression (LR), K-Nearest Neighbors (KNN), Naïve Bayes (NB), Support Vector Classifier (SVC), Decision Trees (DT), Random Forests (RF), and Artificial Neural Networks (ANN). Analysis of the model is done by using various dimensionality reduction techniques like Principal Component Axis (PCA) and Kernel PCA with the visualization of data after applying these, K folds and Grid Search are used for optimization. ANN along with KNN gives the best result with almost 100% accuracy.

**Keywords:** Artificial Neural Networks, Classification Techniques, Mushroom Edibility, PCA, Kernel PCA, Grid Search.

## **Diagnosis of Intracranial Tumor via Selective CNN Data**

### **Modelling Technique**

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**Abstract.** A brain tumor occurs in human beings when a normal cell turns into an abnormal cell inside the brain. Majorly two types of brain tumors are present in human beings that are benign tumors and malignant tumors. Nowadays machine learning and deep learning are playing a crucial function in the field like medical and computer vision areas as this leads reduction in human judgment in the diagnosis and analysis of diseases in human beings. In brain tumor diagnosis we need high accuracy or else a minor error in diagnosis can cause a huge blunder. As

deep learning is playing an important role in the medical field so in this paper we have implemented CNN and ANN of different configurations on binary classification which is based on machine learning with a given dataset of brain tumor MRI scans that depict a person is a brain tumor patient or not. This paper will focus on objective function value obtained by different CNN architectures with a minimum loss, maximum accuracy, and training time which can serve as a viable tool for physicians and the medical community to correctly identify the tumor patients. Experimental evaluations of the best architecture show that a maximum objective function value of 1.84, a validation accuracy score of 0.8275 is achieved & an AUC of 0.737 in the ROC curve to correctly identify whether a person is suffering from a brain tumor or not.

**Keywords:** Convolution neural network (CNN), Machine Learning, Artificial-neural network (ANN).

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## MMCITRE2021 - 057

### A Computational Approach for Disease Diagnosis using Information Embedded in the Relationships between MicroRNA and their Target Messenger RNA

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**Abstract.** Cancer is one of the severe diseases, and it has been biologically observed that miRNAs have an especially critical role as the cause of several types of cancers. It has been observed clinically that micro RNAs have a specific set of target messenger RNAs (mRNAs). In this work, we have studied how certain relationships between miRNA and their target mRNA can be responsible for cancers by experimenting with the samples of miRNA and mRNA for lung cancer. We have proposed an approach to model the miRNA-mRNA relationship through graphical representation for lung adenocarcinoma. It has been observed that one miRNA has multiple target mRNAs, and thus several graphs have been produced because of their relational study. Further, we have used the mean shift clustering approach to specify a particular similar set of graphs of this relationship. The biological characteristics of these graphs can represent the miRNA-mRNA relationships for lung cancer. This same study can be done for several types of cancers.

**Keywords:** mRNA, miRNA, mean-shift clustering.

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**All Access Card**

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**Abstract.** In our modern and fast paced 21st Century, we need everything on the tip of our fingers. To serve this purpose we have developed a model that meets all our needs into a single card. This is the onestop solution for your digital needs. It's a hardware and software integrated chip that enables the user a seamless experience for his/her control of their automobile with industry leading authenticity and security and therefore the name All Access Card. The backbone of this system is RFID. RFID is an identification system which is contactless. It works on the transmission of radio frequency waves. Our system is using RFID based access to all of it's services and access controls in cars of the users. This is a very convenient process as, all you need is this All Access Card which is the same size as your current Credit Card. The working of All Access Card in your automobile is when there is a match between RFID tag in the All Access Card of user and RFID reader used in user's car, the owner's car will unlock their car but while on the flip side if there is a mismatch, an alert message prompting a suspicious activity around the car would be sent to the user.

**Keywords:** RFID, IOT, WSN, Ambient intelligence, NFC, Communication Security, Reliable, Convenient, Digital identity.

**Vehicle Parking Management System**

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**Abstract.** We have observed tremendous economic development and population growth in INDIA in recent years, as a result the number of vehicles on road and number of vehicles per household is increasing day by day leading to more traffic and pollution. Vehicle parking has become a serious problem in everyday life. Over 30% of traffic is due to people searching an appropriate parking location. The Vehicle Parking zone has a number of parking spots. So, it becomes obvious that to park the vehicle one needs to search the free spot. Parking space is a valuable and most undervalued commodity in today's world. Scarcity of parking space leads to more vehicles on the road searching for a parking spot, increasing the air and noise pollution along with traffic. We can manage this by charging the right amount for parking, which can be done by making parking a chargeable commodity and optimizing the space allocation. Issue with Indian metropolitan cities is the demand of on street parking due to less charges than

paying for a proper parking facility. This leads to delay due to increase in congestion and traffic jams. To address this issue, we have tried to develop a hybrid parking system using modern technologies involving RFID sensor, ultrasonic sensors and number-plate detecting camera, this system helps us to monitor and track the entry and exit time of the vehicles determining the charge to pay by the user. The camera scans the number plate of non-RFID(FASTag) users so they can also be guided to the available parking spot as soon as possible saving their valuable time and providing them facility for fast, safe and reliant parking services.

**Keywords:** RFID (Radio Frequency Identification), ANPR (Automatic Numberplate Recognition) camera, TUS-V100 ultrasonic sensor.

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## **MMCITRE2021 - 060**

### **A Contemporary Club Membership Management System**

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**Abstract:** The “Club Membership Management” is a framework that will deal with all the fundamental and minute subtleties effectively with appropriate database security for the privacy of the user. The main objective of our project “CLUB MEMBERSHIP MANAGEMENT SYSTEM” is to upgrade the current system such that it uses less time and gives better results. Our software helps in digitisation of the current manual system. It integrates database tables (which includes data about members, employees, activities, salaries and the payment slips of all members) with a user friendly GUI. While amidst of this pandemic it’s best to have social distancing and if possible no contact at all. So using contactless technology and face and card scanners one can seamlessly enter and use the club’s amenities without worrying about hygiene. Moreover we have integrated temperature scanner and automatic sanitizer dispenser which is an added safety measure.

**Keywords:** Club, Sensors, Temperature screen, face-recognition, card-scanner, sanitiser, Boyce-Codd Normal Form (BCNF).

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**Overstepping No-Ball Detection Using IOT Devices**

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**Abstract:** Cricket is a world-wide popular game that uses various technologies for making decisions according to the rules of the game. All the final decisions are taken with the help of match umpires and often due to human error, there are chances of causing controversies, one such of them is missing an overstepping no-ball. Many controversies have been faced till now on the decision of the match umpire that whether a bowled delivery is a no-ball or a legal ball. As it is rightly said “Improving anything with technology is always advantageous”, so, in this paper, we have come up with an Internet of Things (IoT) based system which will decide whether a bowled delivery is a no-ball or a legal ball. The use of IoT in cricket refurbishes the traditional way of making decisions in cricket. Various sensors and other devices are used to monitor the foot of the bowler and popping crease resulting in the effective decision of a no-ball. The system will help to analyze each and every ball of the match and the data will be collected to the main database system of cricket management.

**Keywords:** Cricket, no-ball detection, database, MySQL, infrared sensors, Node MCU, technology in cricket, IoT, popping crease.

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**Inventory for Artifacts**

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**Abstract.** An artifact is an item made or given shape by humans, such as a tool or a work of art, especially an object of archaeological interest. The artifacts are classified according to their time for creation, the material used for their creation, their utility and the location that they were created. We are planning to have a platform for the inventory and administration of artifacts. To gain information about them has never been easy, even in today's digital age to find a one-stop platform/dashboard for the various artifacts is not easy. The archaeologist, historians, and even, the researchers mapping or expanding their knowledge on artifacts have to go through a lot. We wish to provide that one-stop destination for all the knowledge-hungry people out there. This extensive database would contain all the information on the recently discovered artifacts. To map and gain knowledge of the artifacts is a mammoth task in itself. Even in today's digital world, to have a single platform that has all the artifacts periodically is uncommon. We plan to

eliminate the same discrepancies. Our project is to map all the artifacts from around the globe based upon their era of origin. This will help provide us with a timeline and subtle growths that we have seen from time and now progressing. The varied array of artifacts from around the globe of the same era would help establish how we humans had similar views and thoughts even when we were never connected, which points towards the hive consciousness we possessed long before the era of digital communication.

**Keywords:** RFID, Artifact, database, Database Management System.

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**MMCITRE2021 - 063**

**Revolution in Smart Grid through Databases using Blockchain  
and Internet of things (IOT) in India**

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**Abstract.** - Electricity is one of the most important commodities of human life without which humanity can't be imagined, but high bill rates and external company's charges always remains burdensome for the customers. Here, in this paper we are trying to propose the solution to overcome this problem using distributed architecture and Internet of things. Our approach is here to design the decentralized smart home systems which includes three main components as: cloud storage, smart home, blockchain network. To improve the transparency each smart house is installed with a device known as 'Smart partner' which are responsible for handling all the communications, it includes communication inside and outside the house. As all the communication is being maintained inside the smart partner with the help of mqtt protocol, users remain informed all the time regarding the usage of the energy and power consumed, which ultimately helps them to utilize energy accordingly. The underlying systems which maintain user's information and energy details works under database management principles. We will show that our smart home framework is efficient by analyzing various aspects and will prove its capabilities by handling several challenges as processing time and Energy consumption.

**Keywords:** Smart home, blockchain, Internet of things(IOT), Database management, Smart grid.

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**Control of 7-Level Simplified Generalized Multilevel Inverter Topology for Grid Integration of Photovoltaic System**

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**Abstract.** The present scenario of environmental crisis and energy crisis has led to most of the countries concentrating on increasing the grid penetration of renewable energy sources. Renewable energy sources, such as solar and wind energy, are abundantly available especially in tropical regions and are free from gaseous emissions. Solar photovoltaic (PV) energy system is reported to be integrated with the grid though a dual stage conversion system comprising of dc-dc converter and dc-ac converter. Maximum power transfer is assured by the dc-dc converter and the dc-ac converter ensures grid synchronization and control of dclink voltage and total harmonic distortion (THD) content in injected currents. Generally, 2-level dc-ac converters are employed for integration of small and medium power PV to the grid. However, multilevel inverters (MLI) offer numerous advantages for integration of high-power PV to the grid. The current MLI topologies suffers from the higher switch and capacitor count. In this paper, 7-level simplified generalized MLI topology has been employed for integration of PV arrays with the single phase distribution network. The developed control algorithm comprises of dc-link voltage control, phase locked loop, maximum power point tracking (MPPT), hysteresis current controller (HCC) and switch selector algorithm to ensures that adherences to the standards set by the IEEE 1547. The proposed grid tied 7-level simplified generalized MLI based PV energy system is simulated on MATLAB/SIMULINK and its operation is analyzed considering the case where in the PV array supplies surplus power as compared to the load demand.

**Keywords:** Grid tied inverter, Multilevel inverter, PV energy system, hysteresis current control.

**Identification of Network Attacks through Machine Learning: A Review**

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**Abstract.** With the increasing amount of network throughput and security threat, the study of Network based attacks has received tons of attention throughout the pc science field. Though there's variety of existing literatures to IDS issues, we plan to provide a more elaborate image for a comprehensive review. Various kinds of attacks have various sorts of dangers to network

and system assets. A wide range of attack detection mechanism has been proposed by different attacker, hacker or security experts. This paper surveys diverse sort of conceivable organizes attacks and detection proposed by different analysts that are equipped for recognizing such attacks. Through the extensive survey and sophisticated organization, we propose the taxonomy to outline modern solution for curbing the network based attacks.

**Keywords:** Network, Attacks, Machine Learning, Behavior.

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## MMCITRE2021 - 067

### An Introduction to Parallelisable String-Based SP-Languages

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**Abstract.** We have introduced parallelisable string-based SP-languages as a combination of series parallel languages and parallel series languages. We have represented the parallelisable string-based SP-languages by defining parallel regular expression, parallelisable string-based SPgrammar and branching automaton. Parallelisable string-based regular grammar and parallelisable string-based parallel regular grammar have been defined. Conversion from regular grammar to parallel regular grammar has also been discussed.

**Keywords:** Parallelisable string-based SP-languages, Parallelisable stringbased SP-grammar, Branching automaton

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## MMCITRE2021 - 068

### Detection of Disease using Machine Learning

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**Abstract.** Nowadays, the number of diseases is increasing day by day and the testing rate for the diseases is very time-consuming for both the doctor and patient. More time in detection of the disease means, it will lead to delay of the remedy of the patient. And as we know after the internet boom new technologies are emerging like AI and IoT which are taking the world in a new direction. Using this kind of technology, we can now able to solve problems which were not possible before. So sometimes it's difficult for a doctor to detect disease by seen just an X-ray or microscopic image which results in an increment in disease for the patient having long/short-term disease. By considering this problem the objective is to detect the disease as

accurately as possible which is not possible sometimes for humans to detect more accurately. So, we can take the help of AI where machines can learn from different data and can work on unseen data with higher accuracy. By training machines for the task of detecting disease easily results in, detecting disease at pre-stage and the patient can get proper treatment at an early stage so the life of the patient can be saved and the patient can get recover from the disease as soon as possible. Again, it results in an increasing test of disease easily in a more accurate manner which results in saving time and life both.

**Keywords:** Artificial Intelligence, Medical, AI, Disease Detection, AutoML, AutoKeras, Image Processing, Machine Learning.

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## **MMCITRE2021 - 071**

### **Analysis of RSM method for optimization of Ultrasound-assisted KOH catalyzed biodiesel production from waste cotton-seed cooking oil**

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**Abstract.** Ultrasound-based biodiesel synthesis using waste cotton-seed cooking oil (WCCO) is significant due to cutting down reaction time and being highly energy efficient process. This paperwork focused on a comparison of optimization results of a biodiesel production from waste cotton-seed cooking oil (WCCO) catalyzed by KOH via an Ultrasound (US) based transesterification process using Response Surface Methodology (RSM) based Box-Behnken Design (BBD) and Central Composite Design (CCD) methods. Quadratic polynomial equations are obtained by analyzing experimental values for transesterification reaction. To reinforce the biodiesel yield following parameters are considered: methyl alcohol: oil ratio (molar ratio) (A), KOH amount (wt %) (B), process temperature (C). The impact of these parameters on biodiesel yield is inspected by different plots. It was observed that the catalyst amount found to be the foremost prominent parameter on the biodiesel for both BBD and CCD methods respectively. The process variables optimized for biodiesel yield were in a good match for BBD and CCD methods, individually and found to be methyl alcohol: oil molar ratio: 6:1, KOH wt %: 0.50 % reaction temperature: 50 0C, with the process biodiesel yield: 98 %. An imperative connection with experimental results brings an  $R^2$  value of 98.66 % for the BBD method, while in the CCD

method, the  $R^2$  values is 99.95 %.

**Keywords:** Waste cotton-seed oil (WCCO), Biodiesel, Ultrasound cavitation, RSM, Optimization.

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## MMCITRE2021 - 072

### Development of a mathematical framework to evaluate and validate the performance of smart grid communication technologies: an Indian Case Study

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**Abstract.** Communication technology employed to cater smart grid has been a revolutionized version of an instrumentation telemetry system that apart from facilitating the bidirectional flow of information, provides a seamless interface between the utility and Prosumers. Hence, reliability validation of installed communication technology has been crucial and mandatory for robust system implementation. This paper presents a mathematical framework for run-time performance evaluation and validation of installed communication technology in functional smart grid installation. The presented framework has been tested upon real-time data provided by an Indian utility company and results have been presented. The mathematical framework presented has been simple, customizable and useful for field engineers.

**Keywords:** Communication, Instrumentation Telemetry System, Smart Grid, Validation.

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## MMCITRE2021 - 074

### Early Prediction of Cardiovascular Disease Using One-vs-All Model

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**Abstract.** The rapidly evolving human lifestyle, including eating and drinking habits, workout and resting patterns, consumption of alcohol, smoking habits, work stress, etc often call for several diseases; as such irregularities in lifestyle lead to the improper functioning of many

organs. One of the common diseases caused by such abnormalities is the Cardiovascular Disease (CVD). Today the mortality rate all over the world has drastically increased due to CVD. This drastic increase can be controlled by the early prediction of chances of heart disease in a person using various machine learning technologies. Many data scientists have developed models for the early detection of CVD, however of them focus on binary classification of the patients i.e., either having CVD or not having CVD. Such a broad classification is no doubt helpful in segregating the healthy and unhealthy people but not sufficient to provide the most suitable form of treatment to the patients. In this research work, we have suggested the multiclass classification of CVD affected people into five different classes (0 to 4) with 0 indicating absence of CVD and 4 indicating the presence of the most critical form of the disease. We have recommended the use of the One-vs-All approach for the multiclass classification of people based on the extent to which a person is affected. In this paper, we have compared the performances of the SVM and KNN algorithms implemented with and without the One-vs-all approach showing better performance with OVA approach and further enhancing the performance applying the Principal Component Analysis technique. The results of this study have shown that the best performance that is the highest accuracy of 99.56% was provided by KNN algorithm.

**Keywords:** CVD, One-vs-All algorithm (OVA), Support Vector Machine (SVM), K-Nearest Neighbors (KNN).

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## **MMCITRE2021 - 075**

### **A Review of Z-Source Inverter Topologies in Grid Tied Solar Photovoltaic System**

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**Abstract.** In solar photovoltaic power generation, inverter plays vital role to inject clean power to the grid. Solar photovoltaic output voltage varies with the environmental condition. ZSI can perform buck-boost operation without employment of any additional boost converter. Thus, ZSI enables single stage power conversion. ZSI is one of the most promising inverter technologies which becomes suitable and advantageous to use in the renewable energy sources with the topological improvement. This paper reviews five different ZSI topologies. Comparison of the five ZSI topologies has been carried out. In addition, the grid tied solar PV system with traditional ZSI and qZSI have been simulated in MATLAB and presented.

**Keywords:** Z source Inverter, Photovoltaic, Grid-tied inverter.

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**Developing a meta-heuristic method for solving multiobjective COTS selection problems**

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**Abstract.** This article aims to search for a set of compromise solutions for complex multi-objective COTS selection problems (MCOTSSPs). In contrast, other evolutionary approaches neglect to accomplish bargain arrangement for MCOTSSP or take gigantic endeavors for calculation. This article represents the hybrid version based on the Jaya algorithm(JA) for searching the solution of MCOTSSP by using the exponential membership functions and binary numbers. One mathematical illustration is given with an informational collection from the reasonable and practical state to set up the proposed approach's usefulness. Eventually, the proposed approach results are contrasted with other reputed approaches, and we conclude that the proposed approach is similarly acceptable or more powerful for solving the MCOTSSP.

**Keywords:** Binary Number, Exponential Membership Function, Jaya Algorithm, Multi-objective COTS Selection Problem.

**Energy of 2-Corona of Graphs**

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**Abstract.** This paper develops the corona product to 2 times corona product of graphs and calibrates its energy. The proposed model extends as a graph with two successive generations of complexity, whose structure is constructed as a matrix based on its adjacency. The energy is measured from the total of absolute values of the latent roots of the adjacency matrix of graph G and its largest eigen value is known to be spectral radius. The energy upper bound for 2-corona product of same graphs and different graphs in subsequent products are acquired.

**Keywords:** Eigen values, graph energy, Corona product.

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**Comparison of optimization results of applied RSM methods for  
transesterification of waste cooking oil using microwave assisted method  
catalyzed by CaO**

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**Abstract.** Present study describes the comparison of optimization process parameters determined by employing RSM (Response Surface Methodology) based Full Factor Design (FFD) and Box-Behnken Design (BBD) methods for biodiesel production from waste cooking oil. Using experimental yield values, quadratic polynomial equations are obtained. Parameters are considered to maximize the yield are: methanol to oil ratio (M: O ratio) (A), CaO loading (B), Reaction time (C), for optimization process. The effect of these parameters on biodiesel yield were analyzed by various plots. From perturbation plots, analysis showed that the effect of catalyst loading is highly influential on biodiesel yield than other two parameters. Applying FFD method, the optimum values obtained using Design Expert software for A, B and C are 9.6:1, 1.33 (w/w %) and 9.7 min, respectively with corresponding predicted yield of 91.32 %. At this optimum condition, maximum achieved experiment yield is 90.41 % and matches within error of less than 1%. Similarly, for BBD method, optimum parameters for A, B and C are 9.33:1, 1.37(w/w) % and 9.28 min, respectively and corresponding predicted yield is 90.5 %.

**Keywords:** Production of Biodiesel, modelling, waste cotton-seed cooking oil (WCCO), RSM, Optimization.

**Review of Current Research Going in Data Science and Engineering**

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**Abstract.** Data science is the union of multisectoral field which include diverse algorithms, scientific methods, statistics and tools to extract significant insights from data. In order to understand the actual phenomena of various structured and unstructured data the concept of data

science is introduced. In the era of digitization data science and its applications plays important role which is beneficial in every sector. There are various applications of data science like healthcare, education, banking and finance, product recommendation, digital marketing, road travel, sports, government, e-commerce, social life and many more. Data Science is making a vast variation in making businesses successful, not only in business but also in fields like healthcare, aeronautics, robotics, medicine, etc., it is the game changer. Presently data science used in various field and applications. This research paper talk about the current works and projects going on in the field of data science by various labs all over the world.

**Keywords:** Data Science, Applications, Machine learning.

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## **MMCITRE2021 - 081**

### **Influence of electric and magnetic fields on Rayleigh-Taylor instability in a power-law fluid**

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**Abstract.** Electrodynamic RTI(ERTI) in a thin layer of an incompressible two fluids with a poor conducting fluid confined above by an interface with heavier fluid and below with a rigid boundary subjected to linear stability is analyzed in the present study. A dispersion relation for growth rate of ERTI using linear stability theory was developed. This relation accounting for the growth disturbance is also obtained. The influence of the combined effect of electromagnetic fields, surface tension, power-law fluid, layer thickness on the ERTI using the approximations defined by Rudraiah et al., in 1996 is investigated. It is found that electric field, magnetic field, power-law fluid, and layer thickness stabilizes the system whereas Bond number destabilizes the interface.

**Keywords:** ERTI, Power-law fluid, porous layer, magnetic field.

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**Estimation of Reproduction Number of COVID-19 for the Northeastern States of India Using SIR Model**

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**Abstract.** Coronavirus disease (COVID-19) has been the cause of over a million deaths across the globe. The pandemic has affected the social, economic, and psychological facets of human life. India currently ranks second in the total number of cases in the world. There is an emergent need to understand the severity of the prevalence of the disease in India. In the present work, an SIR model in conjunction with daily case count has been implemented to analyze the transmission dynamics of COVID-19 across the eight northeastern states of India. The parameters associated with this model, namely, the infection, recovery and death rates have been estimated for the northeastern region of India. The infection rate is found to be in the range from 0.18 to 0.49, which is observed to be least in Sikkim and highest in Mizoram. The basic reproduction number for COVID-19 is found to vary between 1.1 to 1.3.

**Key Words:** COVID-19, India, Mathematical Modeling, Basic Reproduction Number.

**Ensemble of Constraint Handling Techniques for PV Parameter Extraction using Differential Evolutionary Algorithms**

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**Abstract.** Parameterized photo voltaic (PV) model accurately predicts the performance characteristics and output of PV Module. These parameters can be obtained from experimental measured performance curves or using technical data sheet. Extrapolating the PV and IV curves obtained using experimental values yield appreciable results with highest degree of accuracy. Due to unpredictable climatic conditions static modelling fails to extrapolate the exact performance curves. This paper unfolds the new method of extracting parameters of PV system. A New approach based on Ensemble of Constraint Handling Techniques (ECHTE) is developed using MATLAB platform. Inspite of various extraction methods presented in the recent survey,

yet there is scope for new estimation method which can address convergence issues and achieve optimized solution under varying environmental condition. The proposed ECHTE based approach has been evaluated with different PV Technologies under varying irradiation condition. The legitimacy of ECHTE was compared with existing state-of-art and on interpreting the results obtained by estimated and experimental values it is clear that ECHTE achieves better results with low Root Mean Square Error (RMSE).

**Keywords:** Energy Conversion Ratio (ECR), Ensembled constraint handling Techniques (ECHTE), Differential Evolution (DE), PV Parameter Extraction.

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## **MMCITRE2021 - 085**

### **Mellin transform of Bose-Einstein integral functions**

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**Abstract.** The Mellin transform of Bose-Einstein integral functions has been discussed in the present work. By the use of Mellin transform, these functions can be expressed in terms of power series, which is well suited for numerical computation in different domains of Physics and Mathematics. The numerical values of the Bose-Einstein integral functions have been computed using Gauss-Laguerre quadrature and their comparative analyses have also been reported.

**Keyword:** Mellin transform, Bose-Einstein integral functions, Gauss-Laguerre Quadrature.

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## **MMCITRE2021 - 089**

### **Stresses and Strain Rates in Creep Deformation Rotating Disc Made of Beryl and Brass Materials with Thermal Condition**

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**Abstract.** The aim of this paper is to develop the mathematical profile of stresses and strain rates in creep deformation rotating disc made of beryl and brass materials with thermal condition by using transition theory of B.R. Seth and generalized strain measures. The solution of the problem has been obtained and depicted graphically. In this paper, it has been observed that the radial stress has a maximum at the inner surface of the disc assembled of beryl material (transversely isotropic). Beryl material required higher value of radial stress at the inner surface

of measure  $n = 1/5$  as compared to the disc assembled of brass material (isotropic), it means that the transversely isotropic material is more comfortable than that of isotropic material. By increasing the values of angular speed and thermal condition, the value of radial stress and also tangential stress must be increased at the inner surface depicted by the graph. With the effect of thermal condition, the values of creep strain rates are also increased at the inner surface of the disc assembled of isotropic material.

**Keyword:** Creep, thermal, stress, strain, beryl, brass, rotating disc.

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## MMCITRE2021 - 090

### Assemblage and refinement of disordered sets of data from various wearable technologies and gears for research purposes and data analysis

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**Abstract.** In the recent times, a steady surge has been seen in the development of wearable technology market. As people are becoming more and more conscious about their health and moving towards a fitter tomorrow, wearable technology has become a necessity. These gadgets contain valuable data of the user (examples: sleep pattern, heart rate, etc.) which is easily accessible. More precisely, this data is already being used for the research purposes. We are working towards an analysing possibility of using the data for first point medical information and accurately predicting maladies before time using machine learning. During the work, we recognized the problems that would thwart the work that we are espousing and have proposed solutions accordingly. This paper provides a panacea to solve all the problems and identify the scope of medical research and patient diagnoses. It proposes a Database Management System for processing and refining data from wearable gears for data analysis and medical research purposes.

**Keywords:** Data Mining, Database, Algorithms, Health, Wearable, Prediction, Modelling, Decision Making.

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**Smart Attendance Management System using Facial Recognition**

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**Abstract.** In recent years, many developments are made for image-based facial recognition algorithms and architectures. One of the most important uses of this technology is maintaining Attendance. The main aim of these developments is to automate the systems and to reduce manual efforts and to reduce human workload and make the system more efficient. This paper proposes an automated Data Base Management system for an automated image-based Facial Recognition system and maintaining attendance in the form of Database.

**Keywords:** Database Management, Image Processing, Facial Recognition system, Attendance management system.

**MChCNN: A Deep Learning Approach to Detect Text based Hate Speech**

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International Institute of Information Technology, Bhubaneswar, India

**Abstract.** Meaningful combinations of words have been used for representation of diverse ideologies and thoughts associated with various demographics and culture around the world, since an ancient time. The exponential development of client created content via web-based media circumscribing hate speech is progressively disturbing. Since the degree of spread of hate speech through internet is expanding, strategies that naturally recognize hate speech require immediate attention. The answer to the issue comes into the picture with Artificial Intelligence. Technology like Natural Language Processing is of incredible assistance, yet we see that utilizing calculations like SVM doesn't yield productive outcomes as wanted, and here deep learning strategies come into help. In our paper, for detection of hate speech, we are using a benchmark dataset from the Kaggle website. We have deployed a novel approach for detection of the hate speech from non-hate speech and we have integrated the GloVe word embedding in our proposed model. The Multichannel Convolutional Neural Network (MChCNN) is used as a base model for binary classification that has performed well by delivering very high testing accuracy. Using our proposed model, we have reached the state-of-the-art result compared to the existing methods. The results obtained from our experiments showcase that our model can be used by researchers for further exploration.

**Keywords:** Hate Speech, Natural Language Processing, Multichannel Convolutional, Neural Network, Deep Learning.

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## **MMCITRE2021 - 095**

### **Cloud Based Smart Warehouse Management System Using RFID**

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**Abstract.** Today with the increase in the demands of goods, we need a smart warehouse management system. The existing warehouses use barcode used systems along with human work, so there are chances of errors and are not secured. With the growth and development of technology, we are moving towards automated systems for more reliable results. The automated systems are quick and much more reliable. It can only happen if we integrate the technology with the database to obtain a smart warehouse management system. This paves way for effective warehouse management. Warehouse management is storing surplus goods in such a way that it makes the system robust and efficient. It includes all the operations from importing goods, managing the goods, to exporting them. The principal idea is to use RFID to manage the warehouse. RFID's have added advantages over ordinary bar codes. The motivation for using it is to store more information. Additionally, we can track the shelves, expiry date, and the data of the customers who will place an order at our warehouse stored in our database. We need an application or website through which we can effectively manage the warehouse. These features will enhance performance and accuracy, eradicating human errors, quick billing management, less wastage of several items, effective use of space, safety, and security.

**Keywords:** RFID: Radio Frequency Identification, FIFO: First In First Out, FEFO: First Expiry First Out, WMS: Warehouse Management System, SaaS: Software As A Service.

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**Collaborative Deployment Strategy for Efficient Connectivity  
in the Internet of Things**

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**Abstract.** Real-time communication is one of the crucial requirements for effective operation in the Internet of Things environment. It needs efficient connectivity and reachability among the nodes deployed in the network. Moreover, the kind of deployment depends on different types of applications and different regions of interest. However, the deployment technique must address the challenges associated with coverage, scalability, and reliability. Also, the different applications need different strategies of deployment in the Internet of Things environment. Furthermore, these challenges affect the efficient operation, especially when a significant amount of heterogeneity is observed among the devices and the communication mechanism. Thus, the Internet of Things environment needs a selective deployment strategy that provides efficient coverage in the network, irrespective of the regions of interest. In this context, this paper discusses the collaborative deployment strategy using both the random and quasi-random based techniques for efficient connectivity among the devices for the clustered Internet of Things environment. The proposed algorithm is implemented and evaluated on the IoT-based platform to show its efficacy.

**Keywords:** Deployment, Connectivity, Internet of Things.

**Driver Drowsiness Detection System Using Eye Tracing System**

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**Abstract.** In the present 21st century a very vast percentage of the population of the world own and use a vehicle according to their earning capacity to commute on a daily basis. Driving and accidents go hand-in-hand together. Nearly 20- 25% of accidents around the world are mainly caused due to the driver's inattentiveness and fatigue. Eyes are one of the most vital sense organs. The movement of eyes along with the position of eyelids determine the attentiveness and the amount of fatigue of the driver. The Viola-Jones method is used in this project since it is a crucial part of modern-age smart-phones which uses face detection as a security measure. Our work aims to figure out a system that monitors driver's drowsiness and distraction level on

the basis of eye tracking. A comparison is given between our method and the other method to show that proposed method gives better accuracy than others. In this paper we have used an eye tracking system for drowsiness detection. The paper describes the application of Viola-Jones Method with Percentage of Eye closure (PERCLOS) as one of the input parameters. The driver is alerted with alarms if the drowsiness index falls under a specific parameter.

**Keywords:** Drowsiness, PERCLOS, Distraction, Fatigue, Viola-Jones Method, Haar-Cascade algorithm.

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## **MMCITRE2021 - 099**

### **Integrated Library Management System**

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**Abstract.** Along with the progression of technology, library should be prepared for a drastic change. This change indulges the innovation into the library management with purpose to hold client's interest in conventional libraries. In this circumstance, library's framework should be improved too, to encourage staff in accomplishing their work viably. Prologue to Library Management System (LMS) helps librarian in accomplishing their work. As the advancement of LMS, Integration of all the departments inside the library shows how LMS is significant and reasonable to the library environment is shown in this paper. The pros and cons of LMS are also detailed analysed in this study. The LMS is an application that helps librarian in managing books and other media items with appropriate manner with full accuracy. The system would provide the appropriate features that are used in day to day life to add , delete , update and many other operations in the database system for the library members. It should provide the complete functionality to handle the management of the Library. LMS is a conventional management system of information regarding library, its Development covers the whole substructure. The maintenance of the Library includes the front-end as well as back-end information for the improvement. Library system requires the consistency and accuracy as the base foundation of the system. The security of the information of library is also a major factor which has to be take under consideration. As compared to the conventional LMS the system should be easy to use and it must fulfil all requirements.

**Keywords:** LMS (Library Management System), Barcode Scanner, UML, Graphical User Interface (GUI), Radio Frequency Identification (RFID), CDS, WinISIS, Bootstrap, MySQL, User Acceptance Test (UAT), Flex Framework, Spring Framework, Hibernate Framework, Library Member Card.

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**Composite Sampling and use of Composite Sampling to Obtain Sample Maximum**

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**Abstract.** Composite sampling is a sampling design where the sampling units in the sample are not subjected to measurement, but composites are formed from several individual sampling units, and measurements are obtained on the composites rather than on individual sampling units. One consequence of acquiring composite sample data is that individual values are not available. This fact does not pose any problem if the interest is in the sample mean. This is so because the forming of composite effectively results in averaging individual values that contribute to the composite measurement. The problem arises when the interest is in the sample maximum. This paper describes a method for obtaining the sample maximum with very few additional observations on select individual sampling units in addition to composite sample measurements. It is interesting in addition to being a cost-efficient method in environmental sampling.

**Keywords:** Composite sampling, sample maximum, composite sample measurement, composite sample size.

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**Multi-Objective University Course Scheduling for  
Uncertainly Generated Courses**

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**Abstract.** This paper is related to Multi-objective University Course scheduling for uncertainly generated course assignment problem for the case when some faculties are left the institution in between semester. To assign generated load or additional courses to existing or newly joined faculties based on preferences given by faculties, administrator and other criteria like result and feedback. So obtained mathematical model will be multi objective university scheduling model which will be solved by Fuzzy programming technique using LINGO18.0 software.

**Keywords:** Timetabling Problem, fuzzy programming technique, mixed-integer programming.

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**Mathematical Modeling on Thermoregulation in Sarcopenia**

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**Abstract.** Sarcopenia is a universal disease that affects both physical and physiological parameters in aging after 50 years. It leads to decrease the spirit of life, and a rise in inability caused by the loss of muscle mass and it's strength. The sarcopenia occurs due to reduce the basal metabolic rate (BMR). In this stage, the body core temperature slightly decreases due to lower metabolic heat production in the body. Else ways, the epidermis and dermis skin layers thickness reduce, as result, its temperatures increase in aging. The high body temperature activates the cooling mechanism and elicit sweat loss and keeps the body in thermoregulation. The approximate value of BMR and skin layered thickness in aging is analyzed in the model. The temperature results are calculated numerically by the finite element method(FEM) in steady-state and have been exhibit graphically.

**Keywords:** Basal Metabolic Rate, Muscle Mass, Resistance Training, Aging, Thermoregulation.

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**A Revisit to the Problem of Flow past a Pair of Separated Solid Spheres**

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**Abstract.** The problem of Stokes flow of a viscous fluid past a pair of separated solid spheres solved by Payne and Pell is revisited in this paper. Payne and Pell worked on the peripolar coordinate system while we consider a bipolar system in this work. One impressive result of this study is that we derived an expression for the drag experienced by the system of two-spheres by modifying the expression that Payne and Pell gave for a general axisymmetric body. Further, this study gave rise to some interesting observations: Though one sphere's presence affects the other, the drag on the system is found equal to the sum of the drag on individual spheres. For spheres of equal radius, we computed the drag on each sphere using the formulae given by Stimson and Jeffery and found that it is precisely half the drag computed on the system. If the spheres are of unequal radius, we arrived at a formula to compute bounds for each

sphere's drag. These bounds included values calculated by Jeffery and Stimson in their work on the motion of two spheres in a viscous fluid. We also observed that the drag on the sphere on which the fluid flows first gets saturated at a value equals the drag on the system with decreasing radius of the other (latter) sphere. Another remarkable feature of our work is that, as a limiting case, we derived the individual spheres' drag, and the values are in excellent agreement with those computed by Stoke's formula for drag on a single sphere. In addition to this, we also carried out numerical evaluations for flow visualization and plots of pressure function.

**Keywords:** Separated Spheres, Bipolar, Gegenbaur functions, Stream function, Drag.

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## **MMCITRE2021 - 108**

### **SHORS: Unsupervised and Corpus-Based Stemmer Technique for Information Retrieval**

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**Abstract.** Stemming techniques are widely known and popular in the field of Natural Language Processing to Information Retrieval. Unsupervised and Language-independent stemmers normalize words using the same corpus without any outside help. The main feature of our algorithm is that we have designs for Indian languages, which are resource-poor as well as high on inflection. This technique also works as a stemmer as well as a lemmatizer. We test our algorithm on Gujarati using collections from FIRE platforms. Significance performance improvement over plain retrieval has been observed.

**Keywords:** Unsupervised Stemmer, Inflection, Information Retrieval, Natural language processing.

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**Improved Lower Bounds on Second Order Nonlinearities of Cubic  
Boolean Functions**

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**Abstract.** Nonlinearity of second order is important in the study of Boolean functions from a cryptographic viewpoint. This property is useful in choosing efficient Boolean functions resisting quadratic approximation attacks. We obtain improved lower bounds with respect to the nonlinearities of second order of some classes of cubic monomial Boolean functions of type  $f(x) = T_r(x^{2^i+2^j+1})$  where  $i, j$  are positive integers and  $i \leq \left\lceil \frac{n}{2} \right\rceil, j \leq i$ . We were able to obtain these bounds in an efficacious way for Boolean functions upto 13 variables. Obtained results refine the bounds obtained by Gode, Gangopadhyay [11] and Mesnager, Kim and Jo [21]. This shows the efficiency of these classes of functions with respect to nonlinearity of second order.

**Keywords:** Symmetric Key Cryptography, Boolean functions, Derivative of Boolean function, Nonlinearity of Second order, Linearized polynomial.

**Rings whose nonunits are multiple of unit and strongly nilpotent element**

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**Abstract.** In this paper we introduce a new class of rings in which each non unit element of a ring R is a product of a unit and a strongly nilpotent element. We obtain various properties and a complete characterization of these rings. We also investigate the subclass of these rings in which this multiplicative decomposition of non-unit elements is unique. In last section we study the group ring of these rings and obtain a complete characterization for the same.

**Keywords:** Units, Nilpotents, Strongly Nilpotents, UN rings.

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**Smart Ticket Management in Railway System using  
Aadhar QR-code and DBMS**

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**Abstract.** In recent years, the technology is growing very fast. Especially the scanner has become a part of our daily life. Objective of this development is to make the smart ticket checking for railway system using QR- scanners. Main purpose of the system is to reduce paper wastage and protect environment by doing digitalization of conventional railway system. With the help of this system human efforts will become less and conventional system will be more efficient. Moreover, system will be effective during pandemic time due to contactless ticket checking and reservation hence it will be more time convenient to railway staff and ticket checker. This paper uses Database Management System, QR scanner and smart device at railway compartment to automate the ticket checking.

**Keywords:** Database management system, QRcode, QR-scanner, Smart ticket checking automation, Railway digitalization, SQLite Database.

**Speech Emotion Recognition Using PySpark**

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**Abstract.** Emotion being an integral part of human behavior, is naturally reflected in the speech through tone and pitch. The analysis and recognition of emotions are of serious importance in today's era of digital communication as they play an important role in communication. One of the most important and contemporary research topics in the Human-Computer Interaction (HCI) domain is Speech Emotion Recognition (SER) whose primary objective is to make man-machine interaction more natural and to be able to recognize emotional states in the same way as humans do. Emotion recognition is a challenging task as every individual has a different way of expressing and it is a subjective aspect. The proposed system aims to recognize specific types of emotions from human speech. This paper presents the use of the PySpark framework to recognize the emotions from a given speech. A set of classifier algorithms that are common to both SkLearn and PySpark.ml are considered for the comparative study of performance and evaluation metrics for the prediction of emotional state based on the RAVDESS dataset. A brief

description of the prime features extracted and that of the working principle is also discussed here.

**Keywords:** Speech recognition, Emotion Recognition, SER, HCI, Apache Spark, Machine learning, MLP Classifier, Random Forest Classifier, Decision Tree Classifier, Librosa.

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## **MMCITRE2021 - 116**

### **An Efficient Image Encryption Scheme Combining Rubik Cube Principle with Masking**

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**Abstract.** In the last two decades chaos mapping centered image enciphering techniques acquired approval against various crypt analytical attacks, but these enciphering algorithms are confined by their insignificant key spaces and weak security particularly if the used chaotic map is one-dimensional. In this paper an efficient private key enciphering scheme for encrypting grey and colour images has been suggested which is centered on the concept of integrating Rubik cube encryption principle with the chaos-based masking of image. Image is first permuted through Rubik Cube encryption technique and further through masking which enhances the security and efficacy of method. The key for creating the mask of image is obtained through Rubik Cube keys and Asymmetric tent chaotic map. Proposed algorithm can encipher both grey and colour images of any size. Security and time analysis are carried through to validate efficiency, robustness and feasibility of the scheme. Compare to recent related encryption schemes this scheme has faster rate of encryption and has better ability to resist various crypt analytical and statistical attacks. Simulation and analysis of the results of the proposed technique are done using MATLAB.

**Keywords:** Image Encryption, Rubik Cube, Chaotic Map, Mask, Statistical Analysis, Differential Attack.

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**Combined Second Order Generalized Integrator –ADALINE Algorithm  
based Fundamental Active Current Extraction for Shunt Active Filtering**

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**Abstract.** With the need of carbon footprint reduction, grid integration of wind and solar energy is on the rise. However, the grid penetration of renewable energy is responsible for power quality degradation, which is responsible for line congestion, reduced transfer capability, increased line losses and poor equipment efficiency. These issues are further increased by the extensive usage of nonlinear loads. This is detrimental to carbon footprint reduction. Shunt active power filters (SAPFs) are devices designed to cater to the harmonic current and reactive power requirement of the loads, and thereby prevent the power quality degradation in distribution network. This filtering improves the efficiency of the distribution network and load equipments, resulting in energy conservation and contributes to carbon footprint reduction. Fundamental active current extraction is integral to the control of SAPF. This paper proposed combined second order generalized integrator (SOGI)-adaptive linear neuron (ADALINE) algorithm based fundamental active current extraction scheme for shunt active filtering. The SOGI separately processes the grid voltage and load currents to determine the unit vector template and fundamental current, respectively. A frequency locked loop is incorporated to eliminate any performance degradation of SOGI with the change in frequency. ADALINE algorithm processes the fundamental load current estimated by SOGI to separate the fundamental active and reactive components of load current. It is demonstrated that the signal processing by SOGI before ADALINE algorithm, results in accurate extraction and reduced computational complexity. The performance of SAPF with the proposed extraction algorithm is analyzed for different operating conditions.

**Keywords:** Artificial Neural Network (ANN), Frequency Locked Loop, Power Quality, Second Order Generalized Integrator (SOGI), Shunt Active Power Filter.

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**On injective objects and existence of injective hulls in  $\text{FTOP}/Y$**

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**Abstract.** In this paper, we have obtained a characterization of injective objects (with respect to the class of embeddings in the category **FTOP** of fuzzy topological spaces) in the comma category **FTOP**/ $Y$ , with the help of their  $T_0$ -reflection. Further, we have proved that for any fuzzy topological space  $Y$ , the statements (i)  $(X, f)$  has an injective hull in **FTOP**/ $Y$ , (ii)  $(\tilde{X}, \tilde{f})$  has an injective hull in  $\text{FTOP}_0/\tilde{Y}$  (where  $\text{FTOP}_0$  denotes the category of  $T_0$ -fuzzy topological spaces and  $(\tilde{X}, \tilde{f})$  is the  $T_0$ -reflection of  $(X, f)$ ) and (iii)  $(\tilde{X}, \tilde{f})$  has an injective hull in **FTOP**/ $\tilde{Y}$ , are equivalent.

**Keywords:** Fuzzy topological spaces,  $T_0$ -fuzzy topological spaces, Comma category,  $T_0$ -reflection; Injective object.

**Lung Disease Prediction Intelligent System by using Deep Learning**

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Archana P. Kale, Gajanan Aochar

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**Abstract.** As we all know COVID 19 has spread all over the world and also the workload has increased on the doctors. In order to solve this critical problem, it is necessary to use the emerging automation trends in the field of Artificial Intelligence. So, this paper proposed Lung Disease Prediction Intelligent System by using Deep Learning algorithms which is specially used for early prediction of COVID 19, need of the society. The key contribution of the paper is the development of the intelligent system by integrating image processing and deep learning algorithms. Artificial Intelligence has greatly evolved over the recent years and it is capable to solve real world problems. For image processing spatial operations and image transformation operations are applied to get the best result of image. The deep learning algorithm consists of convolution layer, pooling layer and fully connected layer. Activation functions such as ReLU and sigmoid are applied to convolution and dense layer to get the output in binary form. In this paper we are introducing some intelligence system to represent image processing and deep learning algorithms.

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**Keywords:** Artificial Intelligence, Image Processing, Spatial & image transformation operations, Pooling layer, Activation Functions.

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## **MMCITRE2021 - 124**

### **Modified Goel-Okumoto Software Reliability Model Considering Uncertainty Parameter**

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**Abstract.** Reliability estimation plays an important role in planning and controlling the software development process. Software Reliability Growth Models (SRGMs) are the most common means of reliability estimation. They analyze failure data set during the testing process to calculate the reliability of a software product. SRGMs are represented with a predefined set of parameters and most of them normally do not consider the uncertainties surrounding them. Therefore, sometimes the estimated reliability on testing phase significantly varies in actual operational phase. In this article, we will explore these uncertainty factors and try to combine them into one parameter and incorporate that parameter into Goel-Okumoto reliability model. The Goel-Okumoto model is one of the simplest and widely used SRGMs.

**Keywords:** SRGMs, NHPP Model, Software Reliability, Software Quality, Software Testing, Software Engineering.

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## **MMCITRE2021 - 125**

### **The Riemann Problem of Conservation laws in van der Waal's Gasdynamic flow**

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**Abstract.** The present study is concerned with the analytical solution of Riemann problem for conservation laws of van der Waals gas. By utilizing Rankine-Hugoniot conditions and Lax entropy condition, we derive classical wave solution of Riemann problem and analyze their properties. Also, it is observed here that van der Waals gasdynamics system is more complex in comparison to ideal gasdynamics case. Further, the effect of presence of intermolecular forces of attraction between the particles and variation of co volume of the gas on the density and velocity distribution across the simple wave, shock wave and contact discontinuities is discussed.

**Keywords:** Riemann problem, van der Waals, Shock wave, Simple wave, Hyperbolic PDEs.

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## **MMCITRE2021 - 128**

### **NLP Based Virtual Assistance System**

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Sakshi S. Katare, Archana P. Kale, Gajanan Aochar

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**Abstract.** Artificial intelligence (AI) technologies are used in most of the intelligent and smart systems. One of the applications of AI is Voice Assistant system which is also called as Virtual Assistant. Virtual Assistant is software that interprets human voice and responds via synthesized voice. Now a day's voice assistant system is becoming vital part of the living being. Therefore, it is necessary to develop a Smart and intelligent voice assistant system. In this paper, Natural language processing (NLP) based Intelligent Virtual Assistant (NI-VA) System is proposed. The key objective of the proposed NI-VA system is to ease the life of individual by supporting various daily aspect of living through a simple but powerful system. NI-VA system uses machine learning algorithm for classification problem. The proposed NI-VA system gathers the result and basic chatter bot system to act as a perfect companion for humans. NI-VA system uses NLP for understanding the normal human language and helps the end user to communicate with the device like voice command.

**Keywords:** Artificial Intelligence, Image Processing, Spatial & image transformation operations, Pooling layer, Activation Functions.

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## **MMCITRE2021 - 129**

### **Land cover changes detection using deep learning with convolutional neural Network**

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<sup>3</sup>ISRO, Ahmedabad

**Abstract.** Land cover classification and change detection analysis based on remote sensing Google earth lansat 7 images using Deep learning with CNN algorithms has become one of the important factors for environmental supervision and urban planning. We select Meghalaya

District as the study area because the government faces many problems Increase in population and pressure on agricultural land has brought huge forest Mass destruction of forest cover leads to desertification and loss of biodiversity on the environment. Burning and changes in land cover is one of the worst impacts on climate as it produces huge

junks of smoke and is released into the atmosphere. Rising of a temperature by a few degrees Celsius. Decline in soil fertility with low yield is common in all the ranges. Late monsoon and warm climate using this algorithm and application one can know which places land cover changes is being done and can take

precautionary steps to prevent the impact on the surrounding environment. Here we collected dataset from LANDSET 7 satellite up to the interval from 2000 to 2019. Approximate 2.5 Lakhs Images we have used in training and testing CNN model to get as much higher accuracy as possible.

**Keywords:** NDVI, Multi-temporal, NDWI, CNN.

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## MMCITRE2021 - 130

### Grid-Tied PV System Operating as Shunt Active Filter with Exponential VSSLMS Based Fundamental Active Current Extractor

Arpit J. Patel, Amit V. Sant

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**Abstract.** Grid-tied solar photovoltaic (PV) system mainly consists of a voltage source inverter (VSI) interfacing solar PV panels with the power grid. These PV systems can be employed as shunt active filter (SAF) at night time and at times of very low irradiance levels, thereby improving system utilization. The operation of SAF ensures power quality enhancement through harmonic current mitigation and reactive power compensation. For the control of SAF, the fundamental active current extraction is a primary requirement. This paper reports a variable step size least mean square (VSSLMS) algorithm based fundamental active current extractor for the control grid-tied PV system operating as an SAF. An exponential function is used to determine the step size for VSSLMS for enhancing the convergence rate while maintaining minimum steady state error. The implementation of exponential VSSLMS involves processing of 3-phase load currents to extract the peak value of the fundamental active component of load currents. The average of the extracted peak values is used to determine the instantaneous 3-phase reference currents with the help of unit vector templates. The developed mathematical model for the control of SAF involves exponential VSSLMS fundamental active current extractor, phase locked loop, dc-link control and hysteresis current control. The performance of this developed system is analyzed for different operating conditions. The use of VSSLMS

extractor enhances performance of the SAF by providing accurate and faster estimation, thereby ensuring the requisite power quality enhancement.

**Keywords:** Adaptive Filtering, Grid-tied Photovoltaic System, Power Quality, Shunt Active Filter, Variable Step Size Least Mean Square.

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## **MMCITRE2021 - 131**

### **A Neoteric Technique using ARIMA- LSTM for Time Series Analysis on Stock Market Forecasting**

Hetvi Shah, Vishva Bhatt, Jigarkumar Shah

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**Abstract.** Stock market time-series analysis and its price prediction have been intriguing the human mind ever since they were in existence. Analysis of time series with the help of various models has become imperative not only in business but also in every day stock market practices as algorithms improve the speed, accuracy, and discipline and one can always back test these strategies to see the type of performance achieved in a real-time environment. Numerous models have been put forward to improve the accuracy and robustness in forecasting market prices. However, due to the high volatility and non-stationary nature of the stock market data, many of these models have been ineffective in forecasting future trends. Addition of artificial neural networks to such models would lead to giant leaps in this domain providing reliable and accurate models as the weights are assigned to the input parameters, are computed in the training phase and are adapted by learning with gradient descent and backpropagation algorithm. This paper proposes an aggregation of the novel autoregressive integrated moving average (ARIMA) model with the long short-term memory (LSTM) model to increase the forecasting accuracy by using the dynamism of neural networks, thereby generating the best-fitted coefficients for the model. The methodology of this model is then evaluated by comparing the empirical results with other conventional models on the Indian stock market data. Accordingly, it is observed that this model achieves significantly better forecasting accuracy and can alternatively be put forward to be used as a suitable model.

**Keywords:** Stock market, prediction, ARIMA, LSTM, Time-Series, Hybrid Approach.

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**Human Video Emotion Analysis using PCA and LDA Fusion Model**

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<sup>2</sup>SVNIT, Surat, Gujarat, India

**Abstract.** Any Human express sentiments by verbal and non-verbal communication. Non-verbal communications are characterized using facial expressions. This manuscript aims to recognized sentiments of human using non-verbal communication by expressions of faces. For this purpose, methods based on mathematics like principle component analysis, independent component analysis and linear discriminant analysis are widely used. This manuscript gears principle component analysis & linear discriminant analysis-based technique for emotion identification from video of multiple persons using neural network, well defined action units for faces given by Ekman and finally fuzzy approach is used. Furthermore, outcomes gained in verbal form by action units with fuzzy methodology on test video with five individual persons for recognition of flora of test video of multiple persons and results are compared by the actual data to authenticate the Model. This paper discusses the implementation of the PCA and LDA fusion based model for single and multiple persons video emotion analysis with fuzzy approach. For video emotion analysis of single and multiple persons, results are obtained using a fuzzy approach which reveals the nature of video.

**Keywords:** PCA (principle component analysis), LDA (linear discriminant analysis), Neural network, Fuzzy approach, Action units.

**A Study with Magnetic Field on Stenosed Artery of Blood Flow**

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**Abstract.** The present study and its mathematical modelling were done to decide the impact of the magnetic field on blood moving through a pivotally asymmetric but radially symmetric atherosclerotic conduit. Herschel-Bulkley fluid model condition has been taken to non-Newtonian character of blood flow in the presence of applied magnetic effect. The mathematical model is analyzed graphically and numerically. It was revealed that within the sight of applied magnetic field, blood didn't definitely change the stream designs, yet caused an apparent decline in the shear stresses and a marginally lower protection from stream. This hypothetical demonstration to cardiovascular infections is considered in our study.

**Keywords:** Herschel-Bulkley fluid flow, Stenosis, Nondimensional flow resistance.

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## **MMCITRE2021 - 136**

### **Deep learning-based detection of COVID-19 using chest X-Ray Images and Convolutional Neural Networks**

Maithili Lohakare, Shaanya Singh

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**Abstract.** The COVID-19 pandemic in 2020 has left a devastating impact globally. SARS-CoV-2 causes adverse lung complications such as Pneumonia, ARDS or Sepsis which calls for the need for rapid and accurate detection of the virus. Combining X-ray imaging modality with Deep learning proves to be cost-efficient amongst other alternatives and reduces diagnosis time. In this proposed research work, the detection has been done in a transfer-learning based manner using state-of-the-art Deep learning techniques which have been proven to be helpful in Computer-aided diagnosis. Several pre-trained convolution neural networks such as ResNet50, VGG-19, Inception V3 and Base CNN were implemented and compared using online publicly available dataset consisting of both testing and training data, which is a mixture of scans of patients infected with COVID-19, Bacterial Pneumonia and healthy individuals. Data augmentation process was conducted to improve the generalization of models and to prevent overfitting. The models were evaluated using training-validation-testing procedure. Amongst the 4 models mentioned above, two of them, VGG-19 and ResNet50, reached higher accuracy than the other two giving upto 95% accuracy giving us the efficacy of the proposed model in the present need of time.

**Keywords:** COVID-19, X-ray imaging, Computer-aided diagnosis, Convolutional neural networks, Deep learning, Transfer learning.

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## **MMCITRE2021 - 137**

### **Numerical Investigation on Performance Enhancement of Solar Panels Using Phase Change Materials**

Rohit Radhakrishnan, Bobin Saji George, Alphi Sioli Mathew, Pran P., Tom Livin S. Vinod  
Mar Baselios College of Engineering and Technology, Thiruvananthapuram, Kerala, India

**Abstract.** Solar energy is truly a renewable form of energy. It is freely available, inexhaustible and does not cause any environmental impacts. Solar cells are optoelectronic devices that are used for direct conversion of solar energy into electrical energy. The efficiency of solar panels mainly depends on three factors - the intensity of solar radiation flux, the quality of the

semiconductor in use and the operating temperature of the semiconductor cell. Temperature plays an important role in determining the efficiency of solar panels.

**Keywords:** Solar energy, Mathematical modelling, Phase Change Material (PCM), Heat transfer Efficiency CFD.

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## MMCITRE2021 - 138

### EEG and IOT Based Taxi System

Kaushal Makadia, Raj Ailani, Romy Patel

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**Abstract.** Internet of Things and Electroencephalography - based BCI technology together can solve numerous problems & can make our day-to-day life easier & safer. A taxi management system that uses IOT and EEG can collect the data of the vehicle & the driver using different IOT sensors from which certain conclusions can be made. From these observations, various actions can be taken which can either minimize the damage or completely prevent it. A lot of research work is going on related to the EEG and IOT and we used the outcomes of those research works to provides multiple features on a single platform. These features include detection of driver braking system, black box system, speed control based on driver vigilance, in-vehicle stress monitoring and wireless pollution testing. This system makes the vehicle as well as the driver safer & thus, aims at the betterment of society.

**Keywords:** IOT, EEG, BCI, Car Safety, Autonomous vehicles, Sensors.

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## MMCITRE2021 - 144

### Automated Office Registration System

Abhishek Rai, Parthiv Gandhi, Ruhin Patel, Shubh Patel

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**Abstract.** Dynamic attendance registration system engineered for increased employee's safety which also decreases queue times and health risks. Face recognition is a crucial bio-metric verification widely used in many areas. This paper describes a method for an employee's attendance system which will also measure their body temperature integrated with an IR equipped HD camera and face recognition technology. This will allow the employee's attendance to be registered in the database without use of any physical touch or an RFID chip.

**Keywords:** Contactless system, bio-metric identification, attendance database, convenient distancing protocol, temperature alarm.

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## **MMCITRE2021 - 145**

### **Single Zonal Building Energy Modelling and Simulation**

Nayan Kumar Singh, V.S.K.V. Harish

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**Abstract.** Building energy control strategies involve development of building energy models with appreciable accuracy. Several methods are available for model development and simulation. Present paper adopts resistance-capacitance network for development of an integrated building energy system model. A white box mathematical model based on principles of building energy physics is developed in MATLAB/Simulink. Differential equations are formulated and modeled in state space form for a multi-layered building construction element. The element is configured as a three resistance and two capacitance model (pi-network) for a single-zonal room by considering the thermal resistance and thermal capacitance of the external walls, window glass, internal walls, ceiling, and floor. Full zonal mathematical model of the building energy system under study is developed. Energy balance equations for each node of the 3R2C model are formulated as differential equations and solved when excited by step inputs. The input parameters for the developed model involve weather parameters of wind velocity, outdoor air temperature; thermos-physical properties of the building construction elements such as thermal resistance and thermal capacitance. The output parameter is building space air temperature for step responses of outdoor air temperature and humidity. Developed modelling routine can act as benchmark for developing energy control strategies and their implementation.

**Keywords:** Building Energy, State Space Model, Single Zonal Model, 3R2C network.

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## **MMCITRE2021 - 147**

### **Advection Diffusion Model to Study the Astrocyte Calcium Regulation in Neurodegenerative Disease**

Hardik Joshi, Brajesh Kumar Jha

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**Abstract.** Calcium ion plays a pivotal role in regulating the astrocyte calcium signaling phenomena. Astrocyte is a part of the glial cells that perform various functions in the human brain in a calcium-dependent manner. A free cytosolic calcium concentration provides a better insight to understand besides physiological process. Thus, modelling of astrocytes calcium

activity is necessary to study the role of aberrant calcium and leads to neurodegenerative disease. In view of this, a mathematical model is framed in the form of an advection-diffusion equation to study the cytosolic calcium concentration. The apposite boundary and initial condition are framed and found the solution of the model by using the Laplace transform technique. The obtained results are interpreted with the neurodegenerative disease.

**Keywords:** Calcium ion, Astrocyte cells, Neurodegenerative disease, Advection diffusion, Laplace transform.

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### MMCITRE2021 – 148

#### **Primitive Idempotents in the Ring $\mathbb{F}_q[x]/\langle x^{16p^n} - 1 \rangle$**

Ashwani Kumar, Manju Pruthi

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**Abstract.** Let  $p$  be an odd prime and  $q$  be an odd number such that  $q = 8k + 3$  with  $p \nmid l \parallel q - 1$  for integer  $l > 0$  and  $4 \nmid q - 1$ . By completing square method, we factorize  $x^{16} - 1$  into irreducible factors over  $\mathbb{F}_q$ , a field of  $q$  elements. In this case we have obtained all the  $9p^n$  irreducible factors of  $x^{16p^n} - 1$  over  $\mathbb{F}_q$  and get the corresponding primitive idempotents, some of which are as follows :

$$\phi_{m_1+k}(x) = \frac{1}{8p^n} \left\{ \sum_{j=0}^{2p^n-1} (-1)^j (\alpha^{8jk} x^{8j} + \dots + i\sqrt{a}\alpha^{8j+7} x^{8j+7}) \right\}, k = 0, 1, \dots, p^{n-1};$$

$$\phi_{m_2+k}(x) = \frac{1}{8p^n} \left\{ \sum_{j=0}^{2p^n-1} (-1)^j (\alpha^{8jk} x^{8j} + \dots + i\sqrt{b}\alpha^{8j+7} x^{8j+7}) \right\}, k = 0, 1, \dots, p^{n-1};$$

For  $m_1 = 8p^n$ ,  $m_2 = 12p^n$  and  $b$  is irrational conjugate of  $a$ .

**Keywords:** Finite field, irreducible factor, primitive root, primitive idempotent.

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### MMCITRE2021 – 151

#### **Novel Generalized Divergence Measure for Intuitionistic Fuzzy Sets and Its Applications in Medical Diagnosis and Pattern Recognition**

Adeeba Umar, Ram Naresh Saraswat

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**Abstract.** The necessity of appropriate divergence measures is arising as they play a vital role in different kinds of problems which are related to dissimilarity, inference and discrimination.

Intuitionistic fuzzy sets are very useful to manage the unassured state of data. For the evaluation of relationships of IFSs, divergence measures of intuitionistic fuzzy sets are necessary. The information of each set in the matrix is formulated by the introduced intuitionistic fuzzy divergence measure, where the matrix under fuzzy environment is applied to find the divergence between the two IFSs. The main motive of this paper is to introduce a novel generalized intuitionistic fuzzy divergence measure with proof of its validity. The proposed divergence measure is applied to the problems of medical diagnosis and pattern recognition on real world data sets to examine the effectiveness and applicability. Also, the proposed method is compared with the existing methods which is demonstrated in an intuitionistic fuzzy environment. It is seen that proposed divergence measure found better results in comparison with the other existing methods.

**Keywords:** Intuitionistic fuzzy set, Medical diagnosis, Divergence measure, Pattern recognition, Decision making.

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## MMCITRE2021 – 153

### An Eco-epidemic Dynamics with Incubation Delay of CDV on Amur Tiger

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**Abstract.** Retrieving the tiger population in the world ecosystem is an important requirement for maintaining ecological balance. Canine distemper virus (CDV) is a deadly infection found in the Amur tiger in the Russian Far East which is one of the important causes of tiger extinction in this region. This study evaluates the influence of CDV on the Amur tiger and other tiger populations in the world. A four-compartment Amur tiger-domestic dog and/or wild carnivores delayed eco-epidemiological model is developed taking incubation period as delay parameter. The existence and boundedness of the solutions are derived. The basic reproduction number  $R_0$  is determined. Local and global stability of the delay model at coexistence equilibrium is established. The system exhibits Hopf bifurcation at coexistence equilibrium for the critical value of bifurcation parameter, i.e. incubation delay.

**Keywords:** Eco-epidemiological model, Stability, Incubation delay.

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**Elastic–Plastic Axi-Symmetrical Bending of Functionally Graded  
Rectangular Wide Plates**

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Sharda University, Greater Noida, Uttar Pradesh, India

**Abstract.** The present problem is based on the study of elastic plastic axi-symmetrical bending of functionally graded rectangular wide plates. The concept of classical theory is applied in the problem and using Tresca's Yield Criterion a second order differential equation is obtained as a governing equation of the problem. The method of infinite series solution is applied to solve the governing differential equation. On the basis of the numerical values and graphs it is concluded that the bending of axis-symmetric wide plates with non - homogeneity parameter ( $k = 2$ ) is on safer side of the design as compared to wide plates for ( $k = 1$ ) this is because of the reason that circumferential stresses are less for bending plate with ( $k = 2$ ).

**Keywords:** Elastic – plastic, Functionally graded, Axi – symmetrical.

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**Ostrowski's Type Inequalities with Exponentially Convex Functions  
and its Applications**

Anulika Sharma, R. N. Saraswat

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**Abstract.** Ostrowski type inequality is known as that estimate deviation of the function from its mean value using different characteristics of the functions. The inequalities have many applications in the area of numerical method and are heavily studies. Now In this paper, solved Ostrowski type inequality with the help of exponentially convex function and exponentially s-convex function in second sense. The applications and particular cases of proposed inequalities have also presented.

**Keywords:** Convex function, exponentially convex, Osrowski's inequality, new f-divergence measure.

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**A Categorical Approach to Fuzzy Automata**

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**Abstract.** In this paper we introduce and study the category of deterministic lattice valued fuzzy automata and the category of deterministic quantale-valued fuzzy automata. Next, we established a functorial relationship between them. The deterministic quantale-valued fuzzy automaton studied here differs from the existing studies in the sense that state-set of such an automaton itself is a quantale module along with the input set as quantale algebra. Interestingly, we show that there is an adjunction associated with both the categories, which is a restriction of the adjunction between the category Set of sets and the category Q-Mod of Q-modules. Furthermore, we introduce a subcategory of the category of deterministic lattice-valued fuzzy automata having both the initial and terminal objects.

**Keywords:** Fuzzy Automata, Fuzzy Languages, Category theory.

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**Crack Detection in Structure by Improved Recurrent Neural Networks**

**Approach**

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<sup>2</sup>School of Mechanical Engineering, KIIT Deemed to be University, Bhubaneswar, India

**Abstract.** The current proposed work is focused to develop a crack detection method for transit mass dynamics problem in the domain of improved Recurrent Neural Networks (RNNs) methodology. A cracked simply support beam subjected to a moving load has been considered as a case study for the present analogy. The knowledgebased Elman's RNNs (ERNNs) approach has been implemented in this problem to find out the position and severity of crack on the beam in a supervised manner. The Levenberg-Merquardt's (L-M) back propagation mechanism or algorithm has been applied to train the knowledge based ERNNs structure. To ensure the robustness of the anticipated method, a numerical problem has been formulated and analyzed. The entire crack detection method has been performed in a supervised mode. The results obtained from ERNNs approach are compared with those of numerical one and found to be well convergent.

**Keywords:** Crack, ERNNs, L-M back propagation algorithm.

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**MMCITRE2021 – 158**

**ON DETERMINATION OF COMMON FACTOR OF  
SYSTEM OF POLYNOMIAL EQUATIONS**

Anjan Debnath

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**Abstract.** In this paper, a square system of polynomial equations with real coefficients has been considered and is shown how to obtain a common factor, if any. Conditions to identify such a system have been established and several important results along with examples have been shown.

**Key Words:** Polynomial, Polynomial Equations, System of Equations, Common Root, Algebra, Linear Algebra.

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**MMCITRE2021 – 160**

**AI based detection and localization of gastrointestinal polyps by using deep learning, transfer learning and the fusion of these techniques**

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**Abstract.** As per World Health Organization (WHO), Colorectal Cancer (CRC) is third most common in males and second most common in women among various type of cancer. Colonoscopy is the brilliant norm for screening of CRC and to detect and localize polyps. Adenoma detection rate (ADR) - the measure of hit rate of endoscopist to locate and remove polyps - has become a key indicator for performance of endoscopist [1]. Artificial Intelligence (AI) assisted examination for detection and localization of polyps may significantly control the high missed diagnosis rate. The Convolutional Neural Network (CNN) based diagnosis systems adapt exceptionally fast for the Computer Aided Diagnosis (CAD) for detection, localization and grouping of polyps. In this paper, we have made an attempt to study the outcomes of CNN and VGG16 independently and then to study the outcomes of fusion of CNN with VGG16. From the present work be obtained the better result from the fusion of CNN and VGG16 compared to the results obtained for independent execution of these architectures.

**Keywords:** Deep Learning, Polyp, Artificial Intelligence (AI), Convolutional Neural Network (CNN), Transfer Learning, Computer Aided Diagnosis (CAD), Colorectal Cancer (CRC), VGG16.

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**DEA-TOPSIS method for ranking of fuzzy portfolios under different risk measures**

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**Abstract.** In portfolio theory, the data envelopment analysis (DEA) method has been extensively used to classify decision-making units (DMUs) as efficient or inefficient. But there is no way in DEA to obtain the ranking order of all the efficient DMUs. The present work deals with this issue by developing a new method called DEA-TOPSIS to obtain a robust ranking of the efficient DMUs. It is a hybrid approach that integrates the DEA method with the technique for order of preference by similarity to ideal solution (TOPSIS). We study fuzzy portfolios under a possibilistic environment. For this, the return from all the risky assets is considered to be the trapezoidal fuzzy number.

Further, all the portfolios under consideration have possibilistic variance or possibilistic semi-variance as the risk measure. Here, random sample portfolios are generated specifically for each type of model. A numerical example is also included to illustrate the proposed approach

**Keywords:** Fuzzy set, Data envelopment analysis, Decision making units, TOPSIS method.

**EDAS method based on generalized distance measure under linguistic Pythagorean fuzzy environment**

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**Abstract.** The linguistic Pythagorean fuzzy set theory provides an effective tool to deal with uncertain information in many complex decision-making situations. Distance measures have been widely used to determine the difference between two sets of objects.

This paper defines a new generalized distance measure between two linguistic Pythagorean fuzzy sets and study its properties in detail. Next, the work extends the evaluation on distance from average solution (EDAS) method under linguistic Pythagorean fuzzy environment. Finally, a numerical example is given to illustrate the decision-making process. The obtained results demonstrate that the developed method is efficient and useful in real-world decision-making problems.

**Keywords:** Linguistic variables, linguistic Pythagorean fuzzy set, decision making, EDAS method.

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## MMCITRE2021 – 163

### Thermal effects in rectangular plate made of Rubber, Copper and Glass materials

Neeru Gupta

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**Abstract.** The objective of this paper is to present the study of thermal effect in the rectangular plate made of rubber, copper and glass materials by using transition theory. The extension and contraction regions presented by the transition points of the differential equation in defining the deformed fields. The analysis also makes the neutral surface separating the two regions. It has been observed that with increased compressibility of materials, the value of neutral axis on the surface of tension must be concentrated on the surface compression. The value of circumferential stress has a maximum at the neutral surface of the rectangular plate made of rubber material in comparison with rectangular plate made of copper and glass materials. With the introduction of thermal effects, the value of the circumference as well as radial stresses increases in temperature and decreases in temperature. Rectangular plate made of rubber material is more comfortable than that of copper and glass materials.

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## MMCITRE2021 – 164

### Two-dimensional Mechanical Stresses of a Thick Hollow Functionally Graded Cylinder under Non-Axisymmetric Loading

Sandeep Kumar Paul, Manoj Sahni

Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India

**Abstract.** In this paper, a thick hollow functionally graded cylinder is considered for the study of two-dimensional steady state mechanical stresses in the radial and circumferential directions under non-axisymmetric loading. Young's Modulus is differing with continuous nonlinear

variation in the radial direction and Poisson ratio is kept as constant. The Fourier half range series and Euler differential equations are considered as the methods of analysis. Mechanical boundary conditions are applied at inner and outer surfaces of the cylinder and the graphs are plotted for derived results. This study may be useful in the application of pressure vessels.

**Keywords:** Functionally graded material, Cylinder, Pressure, Young's modulus, Stresses.

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## **MMCITRE2021 – 165**

### **COVID-19: A mathematical study in uncertain environment**

Meghna Parikh, Manoj Sahni

Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India

**Abstract.** The pandemic of COVID-19 in the 2020 poses an ongoing public health crisis. It threatens to escalate its economic, social, and health effects and is expected to end up as one of the worst global disasters. In the current crisis, mathematical models have played an important role; they have been used to guide strategic decisions and have been effective in Some of the psychological distancing steps that have been adopted around the world. In this article, we review some of the significant mathematical models used to help the ongoing efforts to prepare and respond. In their use, their mathematical structure, and their scale, these models vary. In current epidemics, statistical forecasts are failed to make perfection this situation creates uncertainty in all over the world, with improved computerized statistical models and forecasts, the fast-spreading, forms, and methods involved in controlling a pandemic entail the earliest understanding of finding solutions in order to different aspects of life. Due to inefficient data and the vagueness of the situation of pandemic, we represent the possible solutions of the SEIR model in an uncertain environment using fuzzy numbers.

**Keywords:** SIER Model, Fuzzy numbers, Fuzzy differential equation, nonlinear ordinary differential equation.

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## **MMCITRE2021 – 166**

### **Comparison of Thermomechanical Properties of Functionally Graded Rotating Cylinders for Different Materials**

Parth Mehta, Manoj Sahni

Pandit Deendayal Petroleum University, Raisan, Gandhinagar, Gujarat, India

**Abstract.** In this paper, an attempt is made for modeling of elastic thermomechanical stresses and strains acting on a cylinder made up of innovative material with metal matrix and ceramic reinforcement. Material properties namely, elasticity modulus, density and coefficient of

thermal expansion are varied in radial direction in a power law form. Using equation of equilibrium for an axisymmetric cylinder, relation between stress-strain and strain - displacement, the effect of elasticity modulus, coefficient of thermal expansion, temperature, density on functionally graded cylinder under internal pressure and centrifugal body force is analyzed. Solution for radial stress, tangential stress, radial displacement obtained analytically is compared with numerical solution by conducting finite element analysis for the functionally graded cylinder. Behavior of cylinder with different material combinations is studied and results for thermomechanical radial and tangential stresses are presented graphically.

**Keywords:** Functionally Graded Material, Elasticity Modulus, Coefficient of Thermal Expansion, Thermomechanical Stress and Strain.

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## **MMCITRE2021 – 167**

### **Frobenius Series Solution for Functionally Graded Material with Exponentially Variable Thickness and Moduli**

Manoj Sahni<sup>1</sup>, Ritu Sahni<sup>2</sup>, Nayan Patel<sup>3</sup>, Mukesh Kumar<sup>4</sup>

<sup>1</sup>Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India

<sup>2</sup>Institute of Advanced Research, Gandhinagar, Gujarat, India

<sup>3</sup>Adani Institute of Infrastructure Engineering, Ahmedabad, Gujarat, India

<sup>4</sup>Graphic Era (Deemed to be University), Dehradun, Uttarakhand, India

**Abstract.** In this paper, a Frobenius series solution is obtained for a functionally graded non-rotating cylinder following the exponential law variation in material properties across radii. The plane strain condition is considered in which the strain along the axial direction is taken as zero. The expressions are obtained for stresses – radial and circumferential. The strains are also obtained for functionally graded material considering the problem as axis-symmetric. The expressions for the homogeneous case are obtained by making the material index zero. The graphs are plotted for stresses, strains, and displacements for the homogeneous case and are numerically discussed. The results are obtained under internal pressure in which the external pressure is kept as zero. It is seen that the radial stress is compressive at the internal radii and moves towards zero at the outer radii. The circumferential stress is tensile and is maximum at the internal radii and minimum at the outer radii.

**Keywords:** Power Series Method, Elastic Moduli, Thick-walled Cylinder, Internal Pressure.

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**Study of Nijenhuis tensor, Affine Connection and Conformal curvature tensor on APST– Riemannian manifold**

<sup>1</sup>Amar Nath, <sup>1</sup>Aditya Kumar Chauhan, <sup>1</sup>Mohit Kumar Gupta, <sup>2</sup>Manoj Sahni

<sup>1</sup>Department of Mathematics, College of Engineering Roorkee, Roorkee, India

<sup>2</sup>Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India

**Abstract.** In this paper, creator considered and examined “Nijenhuis tensor, Affine Connection & conformal curvature tensor on Almost Para Sasakian Type-Riemannian differential Manifold”. The primary segment of this paper is introductory in nature, which manages essential definitions and writing survey with past known characterized results. Second, Third and Fourth areas manage Nijenhuis tensor , Affine Connection & conformal curvature tensor with “Almost Para Sasakian Type – Riemannian differential Manifold” (APST-Riemannian differential Manifold ) and “Para K-contact Type Riemannian differential Manifold” (PKCT-Riemannian differential Manifold) and its different applications. As the results of this work further detail hypotheses are recommended for future work.

**Keywords:** “Almost Para Sasakian Type –Riemannian differential manifold”, “Para Quasi Sasakian Type differential manifold”, Para K Contact Type -Riemannian differential manifold, Nijenhuis tensor, Affine connection, Riemannian connection conformal curvature tensor & Geodesic .

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**Fuzzy Mathematical Modelling of COVID-19 using SIR Model**

Ashnil Mandaliya, Parth Mehta, Manoj Sahni

Pandit Deendayal Petroleum University, Gandhinagar, Gujarat, India

**Abstract.** The present paper deals with mathematical modelling of the disease spread by Corona virus, using fuzzy parameters. The Covid-19 pandemic spread by novel Corona virus is the life-threatening disease and almost all the people in the world are affected by it. It has changed everyone's life and caused immense losses quantifiable and unquantifiable. The purpose of this paper is to model the pandemic in a fuzzy environment with an increased accuracy. This is done by taking into account the fuzziness of various factors, mainly the age factor, and formulating the integro-differential equations of the model. Further, a comparison is done between the classical model and the model developed in the fuzzy environment.

**Keywords:** Covid-19, SIR Model, Integro-differential equation, Fuzzy number, Fuzzy modelling.

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**MMCITRE2021 – 171**

**Multi-Criteria Decision Making in the Selection of Biomass Renewable Energy**

Manoj Sahni<sup>1</sup>, Ritu Sahni<sup>2</sup>, Preeti Sharma<sup>3</sup>

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<sup>3</sup>Former Quality Systems Leader (India Operations), Ampacet Speciality Products Pvt. Ltd., Maharashtra, India

**Abstract.** Due to globalization and the current fast depleting resources of energy, the whole world is facing problems arising due to scarcity and nature of the vanishing fossil fuel. The further disadvantage of this fuel is the emissions from the burning of the fuel, which is leading to global warming and other related environmental issues. The scientific community is hence in search of other sources of clean and sustainable Renewable energies viz. Solar energy, Wind energy, Hydro energy and Biomass energy etc. However, the challenge is to find the source of energy, which has strength, can be produced in huge quantities, which is clean and economically cheaper to use. One great idea is to generate energy from the Biomasses. Prima facie, if this can be worked out, it will have some major advantages. Biomass energy is not only being a source of energy but also helping in creating a clean environment by reducing the unwanted biomass. Further it is not affected by global fuel price fluctuation. In India, there are various resources of Biomass (viz. water hyacinth, straw during harvest season, animal waste, garden waste, municipal waste etc.) and all of them have some associated advantages and disadvantages. Here it becomes important to choose the resource carefully to optimize the gain. In this case multi criteria decision-making plays an important role to make the finest decision. In the present work we discuss different criteria for the selection of Biomass energy source and use fuzzy multi criteria decision making as a tool for the selection of the best source that can be useful in the selection of the most appropriate biomass energy resources in India.

**Keywords:** Biomass energy, Multi-criteria decision making, Fuzzy number, Fuzzy modeling.

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**Generalized KKM-Mapping Theorems**

Bhagwati Prasad Chamola<sup>1</sup>, Ritu Sahni<sup>2</sup>

<sup>1</sup>Jaypee Institute of Information Technology, Noida, India

<sup>2</sup>Institute of Advanced Research, Gandhinagar, Gujarat, India

**Abstract.** The theorems regarding KKM maps are considered one of the important results in the fixed-point theory. It is useful in the study of minimax theorem, coincidence theorems and saddle point theorems. The present paper deals with some generalized KKM-mapping theorems using a pair of multivalued mappings in Hausdorff topological vector space. Some well-known results are also obtained as special cases.

**Keywords:** KKM Maps, Multivalued mappings, Hausdorff topological vector space, Finite Intersection property, Brouwer Fixed Point Theorem.

**A family of Fixed Point Based Iterative Methods for Solving Ordinary and Multiplicative Nonlinear Equations**

Manoj Sahni<sup>1</sup>, Dhairy Shah<sup>1</sup>, Ritu Sahni<sup>2</sup>

<sup>1</sup>Department of Mathematics, Pandit Deendayal Petroleum University, Gandhinagar, India

<sup>2</sup>Department of Physical Sciences, Institute of Advanced Research, Gandhinagar, India

**Abstract.** In the present work, we develop a family of fixed-point based techniques in the framework of ordinary and multiplicative calculus for solving the ordinary and multiplicative nonlinear equations ( $f(x) = 0$  &  $g(x) = 1$ ) respectively. We obtain the order of convergence order for all the methods. Also, efficiency index and convergence criteria are discussed of the proposed techniques. The “ordinary calculus method” is third order convergent whereas the “multiplicative calculus method 1, method 2 and method 3” have second, and third order convergence respectively. Further, few mathematical problems and the population growth model are solved using all new methods, which validates the implementation and competence of the new techniques. It is displayed using different plots that all of the newly developed methods are faster convergent than the classical Newton-Raphson method and the multiplicative techniques achieve respectively better results than their own ordinary calculus counterparts.

**Keywords:** Fixed-Point Method, Multiplicative derivative, Multiplicative Nonlinear equations, Numerical Methods, Order of Convergence.

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**Production inventory model for deteriorating items with hybrid type demand  
and partially backlogged shortages**

Himanshu Rathore, Sushil Bhawaria

Manipal University Jaipur, Jaipur

**Abstract.** In present article we have developed a production -inventory model specially focusing on deteriorating with constant rate of deterioration. To put a mark on deteriorating nature we have also focused on preservation technologies. In the model demand are accepted according instant level of stock and the selling price. A hybrid function is used to show the variations of demand with respect to selling price. In case of stock out situation the demand are partially backlogged. The total study is carried under the effect of inflation. The main parameters are production cost, deterioration cost, holding cost, lost sales cost, backlogging cost, and preservation technology. The numerical solution and example are provided to finding this paper, and sensitive analysis of the optimal solutions with respect to main parameters is carried out using the software mathematica-7.0.

**Keywords:** Production, Deterioration, Hybrid—demand, Shortages, Inflation.

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**ANALYTICAL VIEW OF SHIFTING AGE STRUCTURE OF INDIA AND ITS  
ECONOMIC GROWTH WITH THE HELP OF MIXED METHODS RESEARCH**

Jyoti Badge, <sup>2</sup>Priya Dwivedi

VIT University, Bhopal, <sup>2</sup>Lucknow University, Lucknow

**Abstract.** In the context of structural changes of different countries, the two macroeconomic variables like age structure and economic growth are widely discussed terms with respect to their role in the furtherance of the development process. The present paper tries to analyze the upshots of the shifting age structure of India especially the working-age population on its economic growth by mixed-method research. In general, mixed methods research represents research that involves collecting, analyzing, and interpreting quantitative and qualitative data in a single study or in a series of studies that investigate the same underlying phenomenon (Leech N, O. A.-2. (n.d.). Sequential Mixed method design is chosen to gain better insight into the subject matter of the paper. For this attempt major Quantitative analysis- correlation, regression, and ANOVA is performed followed by minor qualitative analysis with the help of a questionnaire is done to confirm the findings and its validity.

**Keywords:** Production, Deterioration, Hybrid—demand, Shortages, Inflation.

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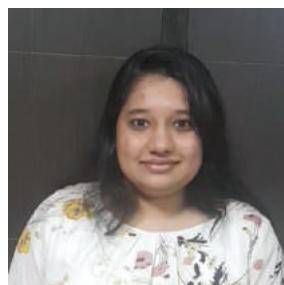
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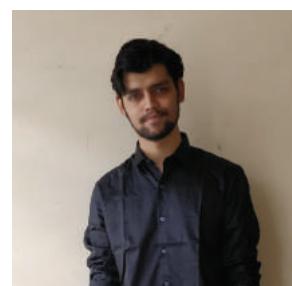
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