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**IEI - TLC - NEWS**  
IN-HOUSE NEWS LETTER OF  
**THE INSTITUTION OF ENGINEERS (INDIA)**  
TIRUCHIRAPPALLI LOCAL CENTRE  
[www.ieitiruchi.org](http://www.ieitiruchi.org)



CHAIRMAN: **Er. N. KUMARESAN, FIE**

HON. SECRETARY: **Er. A. ANAND, MIE**

**IEI - TLC - NEWS**  
**CONVEYS GREETINGS TO ALL**  
**FELLOW ENGINEERS**





## From the Chairman's Desk...

Dear Fellow Engineers,

Greetings.

It gives immense pleasure to inform through this Newsletter that the 34th National Convention on Production Engineers 2019 (NCPE 2019) has been successfully organized by the IEI Tiruchirappalli Local Center under the aegis of the Production Engineering Division Board, IEI. The organising committee have put together great a team work and months of coordinated and dedicated planning which ensured the NCPE 2019 a grand success. As the Chairman of IEI TLC, I would like to congratulate and say thanks to every one of you.

Apart from this, IEI TLC have organised two 2 days All India Workshops, namely, (i) "Application of Computational Fluid Dynamics Techniques in Heat Transfer and Energy Systems" under the aegis of Mechanical Engineering Division during 28-29, June 2019 and (ii) Power Quality Enhancement in Distributed Generation under the aegis of Electrical Engineering Division during 19-20 July 2019 in association with National Institute of Technology, Tiruchirappalli. Both the workshops were well organised and participants are also extended their appreciation. Thanks to the Conveners and organising committee for their dedication and valuable service. Further, IEI TLC has planned to organise more number of workshops and details can be obtained in our website (<http://ieitiruchi.org/>).

As you are aware, every year Tiruchirappalli Local Centre of The Institution of Engineers (India) confers Best Engineer Award upon one of the eminent engineers from the jurisdiction of our center. In this regard, the nomination form, guidelines and eligibility criteria are also included in this newsletter for your information and use. Details can also be obtained in (<http://ieitiruchi.org/>). Please send the nominations on or before 26th August 2019.

As I already mentioned, IEI has completed 99 years of relentless service towards engineering advancement for nation building and is currently marching towards the centenary year celebration. In this regard, IEI TNSC will host the Centenary Inaugural Function on September 13, 2019 at Kalaivanar Arangam, Chennai. The Hon'ble Prime Minister or President is likely to preside over the function. It is my pleasure to congratulate IEI TNSC for hosting this historical event. As the Chairman of IEI TLC, I extend a special request to each and every one you to kindly participate in this mega event at Chennai.

I congratulate the editorial team for bringing out this edition of this Newsletter in a professional way and timely manner. Let us aim to reach further heights with collective efforts and also to bring many honors to IEI TLC. Thank you one and all.

Kumaresan



# contents

- ✓ **IEI-TLC –Upcoming Workshop Details**
- ✓ **IEI, TLC invites Nominations for Engineers' Day Award 2019**
- ✓ **Recent Technical Lectures**



**IEI, TLC organizes All India Workshop on  
“Optical Fiber Technology and Photonic Integrated Devices for  
communication and Industrial Applications”**

It is our great pleasure to inform you that an **All India Workshop on “Optical Fiber Technology and Photonic Integrated Devices for communication and Industrial Applications”** is being organized by our **Tiruchirapalli Local Centre** under the aegis of Electronics and Telecommunication Engineering Division in association with **NIT, Tiruchirapalli** during **Aug 9 - 10, 2019 at NIT, Tiruchirapalli**.

We request you to please make it convenient to attend the programme to make it a grand success and also extend your valuable support and contribution by way of your presence, presenting papers, deputing delegates and the way you would like to do and also provide wide publicity to the aforesaid programme by sharing this invitation among your colleagues & friends for their participation for mutual benefit to the fraternity.

For further details, you may contact:

Hony. Secretary,

The Institution of Engineers (India), Tiruchirapalli Local Centre

BHEL Main Office Road,

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[ieitlc1973@gmail.com](mailto:ieitlc1973@gmail.com)



## IEI, TLC organizes All India Workshop on “Theory and Practice of Sustainable Manufacturing”

It is our great pleasure to inform you that an **All India Workshop on “Theory and Practice of Sustainable Manufacturing”** is being organized by our **Tiruchirapalli Local Centre** under the aegis of Production Engineering Division in association with **NIT, Tiruchirapalli** during **Sep 20-21, 2019 at NIT, Tiruchirapalli**.

We request you to please make it convenient to attend the programme to make it a grand success and also extend your valuable support and contribution by way of your presence, presenting papers, deputing delegates and the way you would like to do and also provide wide publicity to the aforesaid programme by sharing this invitation among your colleagues & friends for their participation for mutual benefit to the fraternity.

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[ieitlc1973@gmail.com](mailto:ieitlc1973@gmail.com)



## IEI, TLC organizes All India Workshop on “Emerging Technologies in Aerospace Engineering”

It is our great pleasure to inform you that an **All India Workshop on “Emerging Technologies in Aerospace Engineering”** is being organized by our **Tiruchirapalli Local Centre** under the aegis of Aerospace Engineering Division in association with **J.J. College of Engineering and Technology, Tiruchirapalli** on **27th Sep, 2019** at **J.J. College, Tiruchirapalli**.

We request you to please make it convenient to attend the programme to make it a grand success and also extend your valuable support and contribution by way of your presence, presenting papers, deputing delegates and the way you would like to do and also provide wide publicity to the aforesaid programme by sharing this invitation among your colleagues & friends for their participation for mutual benefit to the fraternity.

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## IEI, TLC invites Nominations for Engineers' Day Award 2019

Warmest greetings to you and to your family from IEI, TLC.

We are pleased to invite nominations for the "Engineers' Day Award - Year 2019" from the members of IEI, TLC and non-member Engineers residing or working within the geographical area of TLC, nominating self or another Engineer meeting the required eligibility criteria.

Please send the nominations on or before **26th Aug 2019**. IEI, TLC will not be responsible for any postal / courier delay or transit losses. We request you to disseminate this information to your friends/colleagues also.

For further details like nomination form, guidelines, eligibility criteria you may contact.

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# RECENT TECHNICAL LECTURES

Name of Centre / Overseas Chapter:		TIRUCHIRAPPALLI LOCAL CENTRE	
Title of Activity:		Biometric Aircraft : Engg in Nature’s Style	
Activity under Divisional Board		Aerospace Engineering Division	
Date:	02-07-19	Venue:	IEI TLC Institution Building
			
Er.S Arunvinthan M.Tech.,(Ph.D) Research Scholar of Aerospace Engineering SASTRA Deemed University Thanjavur is Presenting a lecture on the Topic through Power Point slides to the participants.		Er.K.Ramadoss FIE former General Manager BHEL Trichy, is presenting Memento to the speaker in the presence of D Dinakaran IEI Corporate Member and working in BHEL Tiruchirappalli	

## Biomimetic Aircraft: Engineering in Nature’s style

The word “Biomimetics” is derived from two Greek words namely “bios” which means life and “mimesis” means mimicry. It was first coined by Otto H Schmitt during the year 1957. Biomimetics is defined as the study of structures and functions of biological systems in the design of engineering systems. Several man-made engineering designs are inspired from the nature since the nature offers the best solution for every challenge through evolution. The imitation from the nature is as simple as a Velcro to a complex stealth shape inspired from the eagles.

In this short note, we will discuss how biomimetics can be employed to solve some of the classical problems of aircraft like limited operational capability and drag reduction. One such fascinating biomimetic study is about the acrobatic manoeuvres of Humpback whales. Since the Humpback whales are known for its huge size, it cannot hunt down its prey in water and therefore, uses a co-operative feeding method called bubble net feeding. During this feeding, humpback whales perform extreme acrobatics like tight underwater rolls, loops and somersaults.



Aerodynamic designers found that the pectoral flippers of the humpback whales have a unique rounded structure called tubercles which is believed to be the reason behind the increased agility of the whales. Being incorporating this technology into the aircraft wings, wind tunnel test results revealed that the modified wings with leading-edge protuberances continues to produce lift even at  $\alpha = 45^\circ$  while the conventional straight wing stalls at  $\alpha = 15^\circ$ . This in turn could help reduce the take-off and landing distance for civil aircrafts and also could improve the turn radius of the aircraft which has a huge potential for fighters. However, a small increase in the drag coefficient has been found. In order to reduce the drag, again another biomimetic solution has been acquired, but this time from a high speed Shark. Morphological investigation of the Short fin Mako shark scales revealed that each and every scale is capable of flexing and bending at an angle ranging between  $30^\circ$  to  $50^\circ$  called bristling angle ( $\beta$ ). This bristling angle helps changing the nature of the surrounding flow by eliminating the vortices arising out of the body. Utilizing this technology in aircraft wing proved to reduce the coefficient of drag by 20% says wind tunnel testing. Hence, it becomes clear that nature has provided another viable solution to the classical problems of aircraft thus resulting in the design of future "Biomimetic Aircraft".



Name of Centre / Overseas Chapter:		<b>TIRUCHIRAPPALLI LOCAL CENTRE</b>	
Title of Activity:		<b>An Insight into Ear Biometric Recognition Techniques</b>	
Activity under Divisional Board		<b>Computer Engineering Division</b>	
Date:	09-07-19	Venue:	<b>IEI TLC Institution Building</b>
			
<p>Dr. R Sowmyalakshmi ,Assistant Professor Dept.of ECE,University college of Engineering (BIT campus) Tiruchirappalli is Presenting a lecture on the Topic through Power Point slides to the participants</p>		<p>Er.T.Kannan Past Secretary Thanjavur Local centre is presenting Memento to the speaker in the presence of Dr.N.Kumaresan Chairman and Er.A. Anand Secretary of IEI -TLC</p>	

An Insight into Ear Biometric Recognition Techniques Recognition of human has become indispensable in every walk of life ranging from human authentication in airports, identification of criminals by police and up to user recognition for access of library resources. Human recognition can be successfully performed using several life science metrics in our day-to-day life with the help of recent state-of-art techniques in human recognition.

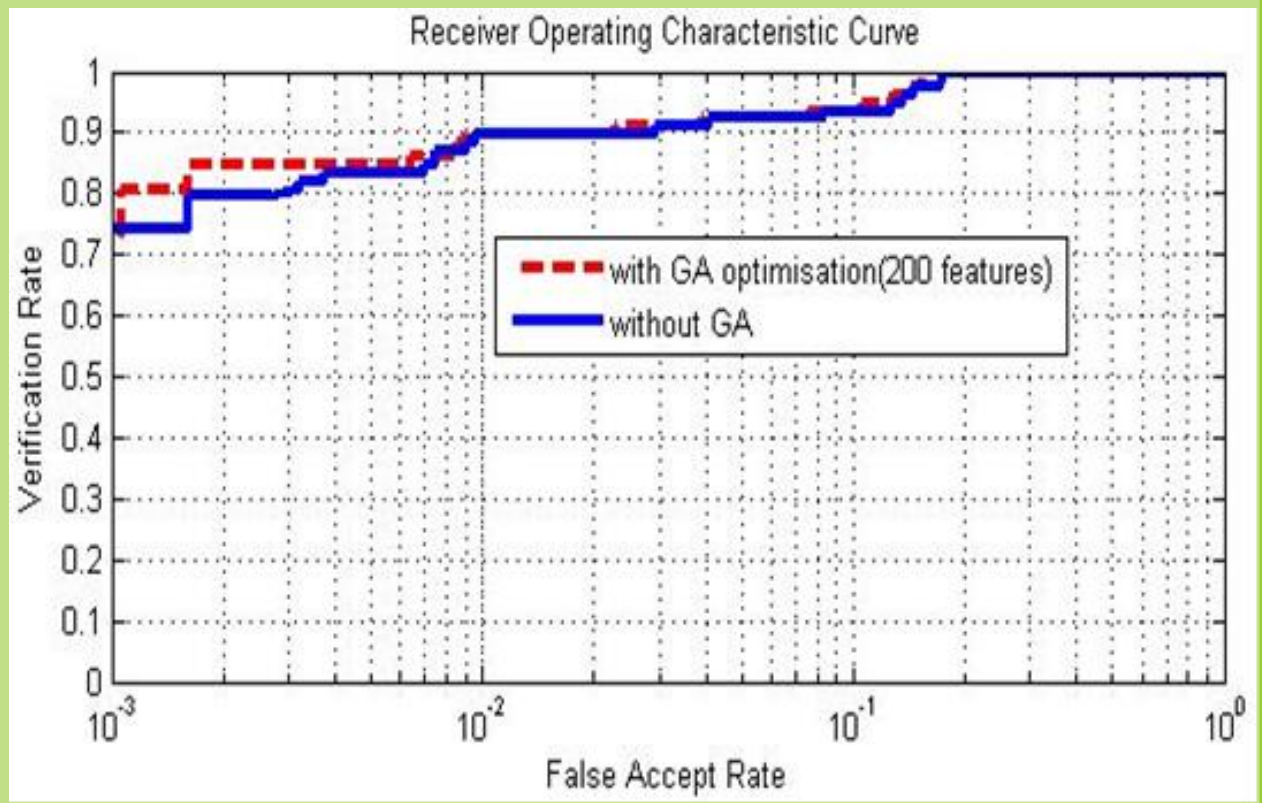
Biometrics deals with human recognition using computational life science measurements and with the deployment of biometric technology, the inappropriate use of debit/credit cards in commercial applications as well as impersonation at polling stations during elections, airports can be drastically reduced. Biometric systems use a variety of physical or behavioral characteristics called modalities, including fingerprint, face, hand/finger geometry, iris, retina, signature, gait, palm print, voice pattern, ear, hand vein, odour or the DNA information of an individual to establish identity. In all these biometric systems involving various modalities, the cooperation of the subject is the most important aspect for the success of a biometric authentication system



The necessity to capture the biometric identity of a non-cooperative individual in public places or constrained environments is highly required due to the threats of terrorists and anti-social elements. This leads to non-invasive method of acquiring the biometric identity of an individual in such really challenging environments. Ear Biometrics is one of the non-invasive biometric techniques, into practical use for security applications in recent years. Feature extraction plays a vital role in any object recognition task. In any biometric recognition system, highly discriminative unique features are extracted from the preprocessed biometric modalities. For ear biometric recognition, the input ear image is first preprocessed to improve its overall visual appearance.

The desired ear region is segmented out from the preprocessed image using constrained Delaunay triangulation segmentation technique. Robust and computationally efficient texture features are extracted from segmented ear modalities and these features uniquely represent ear images of different persons. Further redundancy can be removed by reducing the dimensionality of the extracted feature vectors using Genetic Algorithm based feature selection. These texture based features are extracted from both training (gallery) as well as test (probe) ear images. The performance of the ear biometric recognition system is studied by testing the feature vectors of test (probe) ear images using K Nearest Neighbour (KNN) classifier and Euclidean distance classifier.

Testing is carried out using IIT Delhi and an internal GEAR ear database images. Performance curves of the investigated ear biometric recognition system are studied by plotting Receiver Operating Characteristic Curve (ROC), Cumulative Match Characteristic (CMC) and Expected Performance Characteristic (EPC) curves. Highly appreciable Rank one recognition rate of 94.9% and more is achieved for texture feature extraction based Ear biometric recognition systems. This could pave the way for the development of non-invasive Ear Biometric recognition systems in the near future. Dr.R.Sowmyalakshmi Assistant Professor Department of ECE University College of Engineering (BIT Campus) Tiruchirappalli – 24





Name of Centre / Overseas Chapter:		TIRUCHIRAPPALLI LOCAL CENTRE	
Title of Activity:		Microstructure Simulation- Equal Channel Angular Pressing using DEFORM 3D	
Activity under Divisional Board		Mechanical Engineering Division	
Date:	16-07-19	Venue:	IEI TLC Institution Building



Dr. S Ramesh Kumar, Assistant Professor Research, School of Mechanical Engineering, SASTRA Deemed University Thanjavur is Presenting a lecture on the Topic through Power Point slides to the participants.



Dr.N.Kumaresan Chairman, of IEI -TLC Professor NITT is presenting Memento to the speaker Dr.S.Ramesh Kumar

### Microstructure Simulation – Equal Channel Angular Pressing Using DEFORM 3D

Al 5083 is especially used in aero and automobile industries due to its high strength to weight ratio. Increasing strength without alloying addition will further increase the strength to weight ratio and results in a reduction in the overall weight of the vehicles. Grain refining will improve the strength by the Hall Petch relation. Hence the need for various kind of severe deformation techniques arise to refine the grains by imposing high strains.



Equal Channel Angular Pressing (ECAP) is emerging deformation tool for achieving the high strength by refining grains to nano scales. ECAP was carried out using an optimized die with Channel angle ' $\varphi$ '=90° and corner angle ' $\psi$ ' =20° through processing route A and C up to four passes. The results were studied thoroughly using TEM, SEM, and optical microscopic images. Three-dimensional finite element modeling and simulation of ECAP is attempted using the DEFORM 3D commercial package.

Principle parameters, process conditions, geometries play a most important role in the simulation of the ECAP process. The distribution of effective stress, load curve, and damage of the sample during ECAP with different die corner angles, different die channels, and multiple lengths were simulated, and results are reported. Optimal processing channel angle, die corner angle uniform deformation concerning and load curve of ECAP was simulated.

For entire simulation, work piece was considered as plastic, and the split dies were considered as a rigid material. The punch, upper support, and lower support dies were also considered as a rigid material. The movement of the punch type is lagrangian incremental with the Conjugate Gradient solver using direct iteration method. The local re-meshing method was used to complete finite element ECAP simulation. Microstructure observations were analyzed at different points of the ECAPed billet at various locations. Fig. 1 shows the assembled view of the ECAP setup.



Name of Centre / Overseas Chapter:		<b>TIRUCHIRAPPALLI LOCAL CENTRE</b>	
Title of Activity:		<b>MIMO precoding in 4G and 5G Wireless Technologies</b>	
Activity under Divisional Board		<b>Electronics &amp; Communication Engineering</b>	
Date:	23-07-19	Venue:	<b>IEI TLC Institution Building</b>
<p>Dr. Priya SBM Former Assistant Professor, J.J. College of Engineering &amp; Technology, Tiruchirappalli is Presenting a lecture on the Topic through Power Point slides to the participants.</p>		<p>Er. K. Ramadoss Former General Manager BHEL Tiruchirappalli is presenting Memento to the speaker in the presence of Er. A. Anand Hon. Secretary of IEI TLC</p>	

### MIMO Precoding in 4G and 5G Wireless Technologies

The term wireless communication was introduced in the 19th century and wireless communication technology has developed over the subsequent years. The insatiable demand for high speed mobile data is generating a series of demanding design challenges as today's cellular base stations strain to handle increasingly saturated RF spectrum. The 4G and 5G are the two recent wireless technologies used in mobile communication to fulfil the requirement of high speed data rate. The 4G (4th Generation) brought all IP services, and fast broadband internet access while 4.5G (LTE advanced) doubled the data speed from 4G.



The upcoming 5G technology aims to expand the broadband wireless technologies from mobile internet to IoT (Internet of Things). The higher performance in 5G requires various changes in techniques to improve system performance. One of the formative techniques in improving the data rate of 4G and 5G technologies is MIMO (Multiple Input Multiple Output) and massive MIMO respectively. The MIMO is a system comprising of multiple antennas at transmitter and receiver to improve the system overall performance. The 5G technology enables base stations to support many more antennas than 4G base stations which increases the spatial resolution and consequently increases the spectral and power efficiency of the communications systems. In wireless transmission, the signal may be reflected off buildings and other obstacles. And, these reflections will have an associated delay, attenuation, and direction of arrival causing multi user interference (MUI) among signal. Hence, to ensure reliable downlink transmission, precoding at the base station (BS) is one of the major design aspects to improve the system performance.

Designing an opposite precoding algorithm ensuing dexterous performance with nominal computational complexity is considerably a challenging process in real time scenario. Here, a linear precoder design is discussed to minimize the computational complexity.

A low complex linear precoder is designed by replacing the high complex SVD with QR decomposition and QR-Principle Component Analysis (QR-PCA) for complexity diminution. The simulation results prove that the proposed PCA-MMSE-BD algorithm accomplishes moderately improved sum-rate, lower Bit Error Rate (BER) and simple receiver structure in comparison with the existing precoder.

## References

1. Priya, SBM & Kumar, P 2017, „Design of Low Complex Linear Precoding Scheme for MU-MIMO Systems“, *Wireless Personal Communications*, vol. 97, no. 1, pp. 1097-1116, ISSN: 0929-6212.
2. S Biswas, J Xue; F Khan, T Ratnarajah, “Performance Analysis of Correlated Massive MIMO Systems with Spatially Distributed Users,” *IEEE Systems Journal*, Vol. 12, No. 2, pp. 1850-1861, June 2018.



**IEI – TLC – NEWS solicits technical articles  
from members on various topics for publication.**

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On behalf of the Institution of Engineers (India), Tiruchirappalli Local Centre, published by  
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