

# **International Conference on Innovations in Mechanical Sciences (ICIMS 2021)**

IOP Conference Series: Materials Science and Engineering  
Volume 1132

Kerala, India  
19 - 20 February 2021

## **Editors:**

**Kiran Joy Irimpan  
Jobin Varghese  
Sudhy S. Paniker**

**P.K. Suresh  
Biju P. Augustine**

ISBN: 978-1-7138-3410-6  
ISSN: 1757-8981

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

This work is licensed under a Creative Commons Attribution 3.0 International Licence.  
Licence details: <http://creativecommons.org/licenses/by/3.0/>.

No changes have been made to the content of these proceedings. There may be changes to pagination and minor adjustments for aesthetics.

Printed with permission by Curran Associates, Inc. (2021)

For permission requests, please contact the Institute of Physics  
at the address below.

Institute of Physics  
Dirac House, Temple Back  
Bristol BS1 6BE UK

Phone: 44 1 17 929 7481  
Fax: 44 1 17 920 0979

[techtracking@iop.org](mailto:techtracking@iop.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

INVESTIGATIONS ON JOINING OF HIGH DENSITY POLY ETHYLENE SHEETS USING RESISTANCE WELDING TECHNIQUE.....	1
<i>K. Pradeep, Sudhy S Panicker, K Panneerselvam, P. Asokan</i>	
A STUDY ON MECHANICAL AND DURABILITY PROPERTIES OF STRUCTURAL CONCRETE USING PUMICE AND SINTERED FLY ASH AGGREGATES .....	13
<i>M. Sai Yaswitha Reddy, V.K. Visweswara Rao, M. Srinivasula Reddy</i>	
ANALYSIS ON CRYSTAL FORMATION AND PHYSIO-TRIBOLOGICAL PROPERTIES OF LITHIUM BASED GREASE DEVELOPED FROM COCONUT OIL (COCOS NUCIFERA).....	20
<i>K Joseph Babu</i>	
DESIGN AND FABRICATION OF SIX AXIAL ARM ROBOT.....	31
<i>K N Gunasekaran, C Vasu, Vishnu Ram N S, Raj G Tharun Athi, R S Vijayamoorthi</i>	
BREATH-HOLDING - A STRATEGY IN ENHANCING DRUG DELIVERY TO THE LUNGS: A REVIEW.....	36
<i>R Balasubramanian, J S Jayakumar, Vikas Rajan</i>	
NONISOTHERMAL WARM DEEP DRAWING BEHAVIOR OF AUTOMOTIVE GRADE ALUMINUM ALLOY SHEETS.....	45
<i>Sudhy S Panicker, Sushanta Kumar Panda</i>	
DISTRIBUTION OF EFFECTIVENESS AND NUSSELT NUMBER OVER A CORRUGATED SURFACE IMPINGED BY A ROW OF CIRCULAR JETS .....	54
<i>S Abraham, R P Vedula</i>	
DESIGN OF A LOW-COST LOWER LIMB REHABILITATION EXOSKELETON SYSTEM .....	64
<i>Ullas U, P K Rajendrakumar</i>	
THE ROLE OF BOUNDARY LAYER THEORY IN SOCCER BALL DYNAMICS.....	76
<i>Abhijith Namboodiri Kapothanillath, Sidharth Pradeep, Shriram Sathishkumar, K Balaji</i>	
DESIGN, ANALYSIS, MANUFACTURING AND TESTING OF A SCARA ROBOT WITH PNEUMATIC GRIPPER FOR THE POULTRY INDUSTRY.....	86
<i>Amal Prakash, Anikesh Rajendran, V K Pranav, Pramod Sreedharan</i>	
DESIGN OPTIMIZATION AND ANALYSIS OF EXTERNAL CORRUGATION AND GEOMETRY OF ASYMMETRICAL BELLOW FLEXIBLE PNEUMATIC ACTUATOR.....	93
<i>V K Pranav, Amal Prakash, Anikesh Rajendran, Pramod Sreedharan</i>	
NUMERICAL INVESTIGATION ON LAMINAR CROSS-FLOW AROUND A TOP SURFACE HEATED SQUARE CYLINDER.....	100
<i>K Deepak, V Anandhavishnu, Sujith Stephen, S. Ajith Kumar</i>	
DEVELOPMENT OF AN EFFICIENT FRAMEWORK FOR THE DISTRIBUTION OF ESSENTIAL RELIEF MATERIALS DURING FLOODS BY CLUSTERING TECHNIQUE.....	108
<i>S Sudeesh, K Rameshkumar, S P Anbuudayasankar</i>	
DESIGN AND ANALYSIS OF A SELF-BALANCING BICYCLE MODEL .....	120
<i>G Nitheesh kumar, S Navneeth, A Suraj, Pramod Sreedharan</i>	

POROUS SUPERHYDROPHOBIC MEMBRANES AS SAFE BUBBLE ABSORBERS FOR HYDROCARBON INDUSTRY .....	128
<i>M Kiran Raj</i>	
STEADY STATE THERMAL AND STRUCTURAL SIMULATION OF SS 316L BIPOLAR PLATES USED IN 250 WATT PEMFC .....	134
<i>Robin Raju, Vikas Rajan</i>	
MULTI-OBJECTIVE OPTIMIZATION OF TURBULENT JET IMPINGEMENT COOLING SYSTEM : A THERMAL AND THERMODYNAMIC STUDY.....	144
<i>Prasanth Anand Kumar Lam, K Arul Prakash</i>	
EXPERIMENTING TO OPTIMIZE TOPOLOGY PARAMETERS OF A REINFORCED METAL MATRIX COMPOSITE USING TAGUCHI TECHNIQUE OF DESIGN OF EXPERIMENTS .....	156
<i>Praveen maruthur</i>	
DEVELOPMENT AND FABRICATION OF FUSED DEPOSITION MODELLING 3D PRINTER .....	163
<i>Samson Wilson, Rahul Thomas, Nimmi Mary, Eric Tom Bosco, Ajith Gopinath</i>	
PRODUCT DESIGN AND DEVELOPMENT OF A READING AID FOR THE VISUALLY IMPAIRED.....	172
<i>Ajith Gopinath, Shibin Babu, Allen Bob Claudius, Shaik Mohammed Ismail, O.S Sandeep</i>	
HEAT TRANSFER EFFECT OF LOUVERED BAFFLE IN JET IMPINGEMENT HEAT TRANSFER WITH CROSS-FLOW .....	184
<i>Sabu Kurian, P S Tide, N Biju</i>	
PERFORMANCE ANALYSIS OF SINGLE SLOPE SOLAR STILL INTEGRATED WITH REFRIGERATION SYSTEMS .....	196
<i>V Aneesh, S Vishnu, Arun P Das, M S Ajith</i>	
AERODYNAMIC CHARACTERISTICS OF BASEBALL AND TENNIS BALL USING CFD ANALYSIS .....	207
<i>S Keerthekesh Nadar, T Amrit, S Sanjay Srinivas, K Balaji</i>	
MITIGATION OF SHOCKWAVE INDUCED BOUNDARY LAYER SEPARATION THROUGH A SECONDARY RECIRCULATION DUCT IN A HYPERSONIC FLOW .....	218
<i>Kiran Joy Irimpan, Anand Raj Hariharan</i>	
PRODUCTIVITY IMPROVEMENT — A CASE STUDY OF HINDUSTAN POLYMER PRODUCTS .....	225
<i>S K Akhil, A K Narendran</i>	
FUZZY PROBIST SYSTEM RELIABILITY OF WEAVING MACHINE IN TEXTILE INDUSTRY .....	236
<i>P Jini Varghese, G Michael Rosario</i>	
PROCESS PARAMETER OPTIMIZATION OF WIRE EDM ON WELDMENT OF MONEL 400 AND AISI 316 GRADE STEEL .....	242
<i>P Hema, K Aparna</i>	
MECHANICAL, METALLURGICAL AND CORROSION PROPERTIES OF DUAL PULSED, PULSED GAS AND SHIELDED METAL ARC WELDED AISI 310 AUSTENITIC STAINLESS STEEL.....	249
<i>M Arunkumar, Sudhy S Panicker, P Aneesh Kumar, K Devakumaran</i>	

SUSTAINABLE PROCESSING OF DISSIMILAR ALUMINIUM ALLOY JOINTS BY FRICTION STIR WELDING .....	259
<i>K Ramesha, P D Sudersanan, N Santosh, Sasidhar Jangam</i>	
FABRICATION AND CHARACTERISATION OF PP/TS BIOCOMPOSITES .....	272
<i>S N Sreenivasan, Neethumol M David, Hanna J Maria, Sabu Thomas, Józef T Haponiuk</i>	
EXPERIMENTAL INVESTIGATION ON MECHANICAL PROPERTIES OF JUTE AND HEMP FIBRE BASED EPOXY COMPOSITES.....	278
<i>B Ravi Kumar, S S Hariharan</i>	
SMART READER FOR VISUALLY IMPAIRED USING RASPBERRY PI.....	285
<i>S Sarkar, G Pansare, B Patel, A Gupta, A Chauhan, R Yadav, N B attula</i>	
CONCEPT SELECTION AND KINEMATIC MODELING OF HAND REHABILITATION ROBOTIC DEVICE.....	291
<i>Sunil, Meby Mathew, A.P. Sudheer</i>	
KINEMATIC MODELLING AND STRUCTURAL ANALYSIS OF A SPHERICAL ROBOT: BALL-E.....	302
<i>Satwik Tholapu, A P Sudheer, M L Joy</i>	
KINEMATIC MODELLING AND ANALYSIS OF SINGLE LEG IN HYBRID WHEEL-LEGGED MOBILE ROBOT .....	314
<i>P Arunkumar, A P Sudheer, M L Joy</i>	
MODELLING OF TORSO AND DUAL ARMS FOR A HUMANOID ROBOT WITH FIXED BASE BY USING SCREW THEORY FOR DEXTEROUS APPLICATIONS.....	326
<i>Shifa Sulaiman, A P Sudheer</i>	
DESIGN AND ANALYSIS OF MINIMALLY INVASIVE SURGICAL ROBOT .....	335
<i>Ch. V S N Vasundhara, A P Sudheer</i>	
EXPERIMENTAL STUDY ON GEOPOLYMER RUBBERIZED CONCRETE USING NATURAL ZEOLITE.....	344
<i>Suthari Bhavani, G. Nagesh kumar, M. Srinivasula Reddy, E. Sanjeeva Rayudu</i>	
COMPARATIVE ANALYSIS OF AN ENVIRONMENTALLY FRIENDLY REFRIGERANT WITH DI WATER WHEN USED IN A THERMOSIPHON HEAT PIPE .....	354
<i>K.S Vivek, Arun Kurien Reji, A Abdulriyazdeen, S Abishek</i>	
EFFECT OF WALL-SLIP ON NATURAL CONVECTION IN A SQUARE CAVITY .....	360
<i>Kartik Suresh, C K Arjun, Damu Murali, S Ajith Kumar</i>	
EFFECT OF BAFFLES POSITION ON THERMO-HYDRAULIC EFFICIENCY OF A SOLAR AIR HEATER .....	369
<i>Rahul Kumar Bhattar, Ali Abbas, Anant Kumar Rai</i>	
EFFECT OF WALL-SLIP ON NATURAL CONVECTION IN A CIRCULAR ANNULUS .....	381
<i>Gautham S. Nair, R. Harikrishna, Damu Murali, S. Ajith Kumar</i>	
EFFECT OF WALL-SLIP ON NATURAL CONVECTION IN THE ANNULUS BETWEEN A CIRCULAR CYLINDER AND SQUARE ENCLOSURE.....	392
<i>A S Ananthapadmanabhan, Sabin Santhosh, Damu Murali, S Ajith Kumar</i>	

CHEMICAL AND ENZYMATIC TRANSESTERIFICATION OF RUBBER SEED OIL – A COMPARATIVE STUDY .....	402
<i>Eldhose K Joy, Jilse Sebastian, K K Eldose, S R Jithesh</i>	
DESIGN OF A SUSTAINABLE FLOOD CARRIER SYSTEM IN CUDDALORE OF TAMILNADU .....	418
<i>P K Suresh, S Sakthival, R Sundaravadivelu, P C Aneesh</i>	
DESIGN AND ANALYSIS OF A SOLAR DRIER WITH A PARABOLIC SHAPED DISH TYPE COLLECTOR FOR DRYING PEANUT .....	427
<i>Jobin Varghese, S Rupesh, Jithu Augustine, Adithya Nair, Prajith</i>	

**Author Index**