

Name : Dr MRUTTANJAYA ASPALLI		
Designation: Professor		
Education Qualification	Ph.D	
Teaching Experience	24 yrs	
Area of Interest	Power Electronics and Drives, Power Quality Issues, Renewable Energy Sources.	
Email-id	maspalli@gmail.com	
Contact No.	9449618898	
Papers Published in International Journals : 57		
Papers Published in National Conference : 05		
Papers Published in International Conference : 17		
List of Publications: Enclosed.		
Subjects Taught: Power Electronics, HVDC Power Transmission, Solid State Power Controllers, Resonant Converters, Power Quality Issues & Mitigations,		
The role in curriculum development of Electrical & Electronics Engineering Program.		
<p>I am working as professor and the course coordinator for M.Tech Power Electronics at Department of Electrical & Electronics Engineering, Poojya Doddappa Appa College of Engineering, Kalburagi, Karnataka, India and an Autonomous Institution. I have published 79 papers in national and international journals and conferences which are in the field of power electronics. The role in curriculum development include: Administrative and Academic activities of M.Tech Power electronics Course i.e course planning, course design and development, course delivery, selection of educational resources, assessment, students' learning outcomes and course evaluation, conducts regular class works, seminars, industrial visits and monitors and guides dissertation works taken by the M.Tech students Under my guidance 96 students have completed M.Tech Power Electronics project work. Three (03) research scholars are working under me and their work is related to field of power electronics. I have published a book titled "Microcontroller Based Controller for Three Phase Induction Motor" (ISBN-978-620-0-5349-8) Publishers: LAMBERT Academic Publishing, UK. I have delivered many expert invited talks on power electronics & drives, power quality issues & solutions, applications of power electronics to electric vehicles. I have also conducted FDP / workshops on power electronics & drives and power quality issues and mitigations. My fields of interest are Non-conventional energy (solar PV, wind): Power conditioning, maximum power point tracking, stand-alone and grid connected systems. Design of converters for renewable sources integrations, Power Quality and its related issues, Power Electronics and Drives.</p>		
Details of membership of Professional Bodies :		
<ol style="list-style-type: none"> 1. Member of Indian society for Technical Education (ISTE). 2. Member of the Institution of Electronics and Telecommunication Engineers (IETE). 3. Member of the Indian science Congress Association (ISCA). 4. Member of Indian Society for Lighting Engineers (ISLE). 		

5. Member of Fellow of Institution of Engineers India.(FIE)

Workshops Attended: 24.

Attended and awarded the certificate for The AICTE-UKIERI Technical Leadership Program i.e UK-INDIA Education and Research Initiative Program which is jointly organized by Dudley College, UK and AICTE New Delhi.

Workshops/Training Programs/ Lectures Organized:

1. Three Days Workshop on “Power Quality Issues and Mitigations” from 24th to 26th, October 2016.
2. Six Days Workshop on “Power Electronics and Drives” from 5th to 10th, March 2018.

Book Published and Expert Invited Talks Delivered:

2. Microcontroller Based Controller for Three Phase Induction Motor. (ISBN-978-620-0-5349-8) Publishers: LAMBERT Academic Publishing.
3. Delivered Expert talk on “Introduction to Power Quality Issues and solutions” at AICTE sponsored STTP on “Recent Trends in Electrical Drives and their applications at YCCE, Nagpur on 5th Nov-2019.
4. Key note lecturer on “Electric vehicles” at ICAEM 2019 during 20-21 December 2019 held at JIET, Jodhpur.
5. Delivered Expert talk on “Importance of Power Quality in Power Distribution Systems” at Two Week Refresher course on “Power Systems” at JNTU, Hyderabad held from 1st to 16th, March-2021.
6. Delivered Expert talk on “Micro grid and its Importance in the present scenario” at One week Induction Program on “Micro Grid Scenario and Control” organized by RIET, Jaipur from 27th April to 3rd May, 2021.

Publications

Sl. no	Title of the Paper	Authors	Journal Name with ISSN	Month, Year & Vol no.	Impact Factor
1	Analysis and Design of High Efficiency High Gain non Isolated Interleaved DC- DC Converter with Reduce Voltage Stress on the Devices	Azara Fatima, M.S Aspalli	Compliance Engineering Journal, ISSN NO: 0898-3577.	2020, Volume 11, Issue 7,	2.183
2	Design and Simulation of High-Efficiency High Gain non Isolated Interleaved DC-DC Converter with Reduced Voltage Stress on the Devices.	Azra Fatima, M.S.Asapalli	International Journal of Innovative Technology and Exploring Engineering	October 2020, Volume-9 Issue-12,	No Impact factor. (Scopus Indexed)

			(IJITEE). ISSN: 2278-3075		
3	A Transformer less Buck-Boost Converter with Single Switch	Channamma. S. Patil, M. S. Aspalli	International Journal of Innovative Technology and Exploring Engineering (IJITEE). ISSN: 2278-3075	October 2020, Volume-9 Issue-12,	No Impact factor. (Scopus Indexed)
4	Design and Analysis of Interleaved KY Converter with Reduced Voltage Stress on the Devices	Azra Fatima, M.S.Aspalli	International Journal of Information Technology and Electrical Engineering. ISSN: - 2306-708X	October 2020 Volume 9, Issue 5.	UGC Approved Journal.
5	Direct Torque Controlled Semi Converter -Three Phase VSI Fed Induction Motor Drive with Enhanced Time Responce.	Geeta. M.S.Aspalli	LINO. ISSN – 0211-2574	2021, VOLUME 11 ISSUE 02.	No Impact factor. (Scopus Indexed)
6	A Nine-Level Switched Capacitor Type Inverter with Boosting	Nitin kumar, M.S.Aspalli, Sushma Patil	International Journal of Information Technology and Electrical Engineering. ISSN: - 2306-708X	June 2020 Volume 9, Issue 3.	UGC Approved Journal.
7	A Cascaded H-Bridge Multilevel Inverter with Reduced Number of Switches	Ranjeeta Sugandhi, M.S.Aspalli	International Journal of Innovative Technology and Exploring Engineering (IJITEE). ISSN: 2278-3075	October 2020, Volume-9 Issue-12,	No Impact factor. (Scopus Indexed)
8	A Five-Level Cascaded H-Bridge Multilevel Inverter with Reduced Number of Switches	Ranjeeta Sugandhi, M.S.Aspalli, Sushma J.Patil.	International Journal of Information Technology and Electrical Engineering. ISSN: - 2306-708X	June 2020 Volume 9, Issue 3.	UGC Approved Journal
9	Performance Analysis of ANN/FLC with Hybrid Energy Storage System for Electric Vehicles with Energy Recovery Scheme based on Regenerative Braking.	Sadaf Rakshan, M S Aspalli	Compliance Engineering Journal, ISSN NO: 0898-3577.	2020, Volume 11, Issue 7.	2.183

10	Design of Hybrid Controller for PV sourced Electric Vehicle with Hybrid Energy Storage System using Regenerative braking	Sadaf Rakshan, M S Aspalli	International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075	Nov-2020, Volume-10, Issue-1.	No Impact factor. (Scopus Indexed)
11	Performance Analysis of MFB Controller Combined with ANN/FLC for Smooth Transition with Hybrid Energy Storage System for Electric Vehicles with Energy Recovery Scheme	Sadaf Rakshan, M S Aspalli	International Journal of Information Technology and Electrical Engineering. ISSN: - 2306-708X	Aug-2020, Volume9,Issue 4.	UGC Approved Journal
12	Fuzzy-PI Controlled Cascade H-Bridge Inverter Fed Single Phase Induction Motor Drive.	Sushma.J.Patil, M.S.Aspalli	International Journal of Scientific & Technology Research Volume 9, Issue 04, April 2020. ISSN: 2277-8616	April-2020, Vol 9, Issue04.	No Impact factor. (Scopus Indexed)
13	A Transformerless Buck-Boost DC-DC Converter with Single Switch		International Journal of Information Technology and Electrical Engineering. ISSN: - 2306-708X	June-2020, Vol 9, Issue 03.	UGC Approved Journal
14	Modelling and Simulation of a Non Confined Bidirectional DC DC Converter with High Voltage pick up.	Vaishali, M.S.Aspalli	Journal of Emerging Technologies and Innovative Research (23495162) UGC listed Journal No 63975	2018, Vol 5	5.87
15	Modelling and Simulation of Single Phase Matrix Converter as a Cycloconverter an inverter and as a Rectifier using Power MOSFETs	Trilochan Koulagi, M.S.Aspalli	Journal of Emerging Technologies and Innovative Research (23495162) UGC listed Journal No 63975	2018, Vol 5	5.87
16	Implementation of Cascaded High Step Up DC DC Converter using Three Winding Coupled Inductor	Sheetal Biradar, M.S.Aspalli	Journal of Emerging Technologies and Innovative	2018, Vol 5	5.87

	and Diode Capacitor Technique.		Research (23495162) UGC listed Journal No 63975		
17	Speed Control of Three Phase Induction Motor using Volts Hertz Control Method	M.S.Aspalli,Sunil Kalshetti, P.V.Hunagund.	International Journal of Electronics Engineering (09737383).Serials Publications. UGC Listed journal No:2946	2011,Vol 3.	No Impact Factor
18	Automated Power Factor Correction and energy Monitoring System using Static Compensation Method.	Sudharani, M.S.Aspalli	Journal of Emerging Technologies and Innovative Research (23495162) UGC listed Journal No 63975	May,2018.Vol 6, Issue 6	5.87
19	MPPT Based Solar Power Generation System with Seven Level Inverter.	Veena, M.S.Aspalli	Journal of Emerging Technologies and Innovative Research (23495162) UGC listed Journal No 63975	May,2019. Vol 6, Issue 5.	5.87
20	Development and Analysis of Variable Frequency Three Phase Induction Motor Drive.	M.S.Aspalli, Vinay Kumar, P.V.Hunagund.	International journal of Emerging Technologies and Applications in Engineering Technology and Science. (09743588)	July-Dec2010, Vol 3.	No Impact Factor.
21	A New Generation VLSI Approach for V/F Control of Three Phase Induction Motor.	M.S.Aspalli, Veerendra.D P.V.Hunagund.	International Journal of Computer Science Issues.(1694-0814)	Nov 2011 Vol 1	No Impact Factor.
22	Speed Control of Three Phase Induction Motor using VLSI.	Shalini.N.Malipatil, M.S.Aspalli, P.V.Hunagund,	International Journal of Advanced Information Science and Technology. (2319-2682)	Dec 2012 Vol 8.	No Impact Factor.
23	Operating Three Phase Induction Motor Connected to Single Phase Supply.	Shivangouda.B.Patil, M.S.Aspalli.	International Journal of Emerging Technology and Advanced Engineering.(22502459)	Nov 2012 Vol2	4.027

24	Universal Integrated Smart Power Supply.	Jagdish Patil, M.S.Aspalli.	International Journal of Emerging Science and Engineering. (23196378)	Aug-2013 Vol 1	1.19
25	Speed Control of Induction Motor using DSPIC30F2023.	M.S.Aspalli, Laxmi.	International journal of Engineering Research and Development. (2278067X) UGC Listed Journal No: 48012.	Sep-2013 Vol 8, Issue 7.	No Impact Factor
26	Speed Control of Three Phase Induction Motor by Variable Frequency Drive.	Madivalappa.B., M.S.Aspalli.	International Journal of Advanced Research in Computer Science and Software Engineering. (2277-128X)	Dec-2013 Vol 3, Issue 12.	No Impact Factor.
27	Speed Control of Induction Motor using DSPIC30F2023.	M.S.Aspalli, Laxmi.	Golden research Thoughts. (22315063)	Sep-2013 Vol 3, Issue 3.	1.2
28	Digital signal Controller Based Four Switch Three Phase Inverter Fed BLDC Motor Control.	M.S.Aspalli, Farhat Mubeen.M.Munshi.	International Journal for Scientific Research and Development. (2321-0613)	2014. Vol 2, iSSUE 7.	4.316
29	Speed Control of BLDC Motor with Four Quadrant Operation using DSPIC.	Savitri.L.Medegar, M.S.Aspalli.	International Journal for Scientific Research and Development. (2321-0613)	2014. Vol 2, iSSUE 7.	4.316
30	High Frequency DC-DC Converter design using Zero Voltage Switching.	Parimala.S.K., M.S.Aspalli, Laxmi Deshpande.	International Journal of Science Environment. (2278-3687)	2014 Vol 3, No 2	4.829
31	Application of Single Phase Matrix Converter Topology to an Uninterruptible Power Supply Circuit.	M.S.Aspalli, SyedaRumana Mohammadi.	International Journal of Research in engineering and Technology. (23217308)	May-2014 Vol 3, Spl 3.	No Impact Factor
32	Three Level Single Stage PFC Converter.	Sushma, M.S.Aspalli.	International Journal of Science and Research. (23197064)	Sep-2017 Vol 6, Issue 9.	6.391
33	Interfacing Advanced Power Electronics System for Electric Vehicle Application using MATLAB Simulink.	Gururaj Patil, M.S.Aspalli.	International Journal of Science Engineering and Technology Research. (2278-7798)	Dec-2015. Vol 4, Issue 12.	3.59
34	Enhancement of ESP Performance using ARECA Microcontroller.	Savita Naik, M.S.Aspalli.	International Journal of Engineering Research and	Aug-2015 Vol 4, Issue 8	2.85

			Technology.(22780181)		
35	Soft Start of an Induction Motor with Reduction in Torque Pulsation during Starting.	Shweta.V.Muttagi, M.S.Aspalli.	International Journal for Scientific Research & Development. (23210613)	2015 Vol 3, Issue 2.	4.396
36	Dynamic d- q Model of Induction Motor using Simulink.	Anand Bellure, M.S.Aspalli.	International Journal of Engineering Trends and Technology.(2231-5381)	June-2015 Vol 24, No 5.	2.88
37	Cascaded Multilevel Inverter Topology with Reduced Number of Switches.	Ashwini.S.Sawan, M.S.Aspalli.	International Journal of Science and Research.(23197064)	Sep-2017 Vol 6, Issue 9.	6.391
38	A Valley Fill SEPIC Derived Power Factor Correction Topology for LED Lighting Applications using Digital Controller.	Mallikarjun Ambiger, M.S.Aspalli.	International Journal of Engineering Science & Research Technology. (2277-9655) UGC Listed Journal No: 48486.	April -2016 Vol 5.	3.785 Thomson Reuters indexed.
39	Automatic Liquid Filling to Bottles of Different Height using PLC	Mamatarani Panny, M.S.Aspalli.	International Journal of Scientific Engineering and Research. (2347-3878)	Aug- 2016. Vol 4, Issue 8.	3.791
40	Design and Implementation of Bidirectional Converters for Electric Vehicle Application.	Gururaj Patil, M.S.Aspalli.	International Journal of Scientific Engineering and Technology Research. (2319-8885)	April-2016. Vol 5, Issue 9.	3.59
41	Speed Control of BLDC Motor using PID Controller and Genetic Algorithm.	Priyanka, M.S.Aspalli.	International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering. (2278-8875)	May 2017. Vol 6, Issue 5.	5.621.
42	Three Phase Induction Motor Drive using IGBT's and Constant V/F Method.	M.S.Aspalli, Asha.R, P.V.Hunagund.	International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering. (2278-8875)	Nov-2012. Vol 1, Issue 5.	5.621
43	Design and Development of High frequency Resonant Transition Converter.	Parimala.S.K., M.S.Aspalli, Laxmi Deshpande.	International Journal of Research in Engineering and	May-2014 Vol 3, Spl Issue 3	NA

			Technology. (2321-7308)		
44	Single Phase AC - AC Converter with Improved Power Factor for Induction Motor.	Shivaleela, M.S.Aspalli.	International Journal of Research in Advent Technology.(2321-9637)	May-2019 Vol 7, No 5.	3.92
45	Buck Converter Based LED Driving Topology for Solid State Luminaire	Jitendra Bakliwal , Mruttanjaya Aspalli	<i>International Journal of Computer Science Trends and Technology (IJCST)</i> (2347-8578)	<i>Jul-Aug 2021, Volume 9 Issue 4,</i>	
46	Analysis of voltage drop in high power lithium-ion battery during charge & discharge cycles at different c-rates & temperatures	Jairam CDM, Mruttanjaya S. Aspalli#	Strad Research. ISSN: 0039-2049	VOLUME 8, ISSUE 11, 2021	
47	Understanding the Effect of Current Rate and Temperature on High Power Lithium Ion Battery.	Jairam CDM , R Sneha , Kuldeep Rana , Mruttanjaya S. Aspalli.	GRADIVA REVIEW JOURNAL ISSN NO : 0363-8057	VOLUME 7 ISSUE 9 2021	
48	Design and Simulation of Single Phase Differential Boost Inverter based Induction Motor Drive.	Girija Bandgar, M.S.Aspalli.	GRADIVA REVIEW JOURNAL ISSN NO : 0363-8057	VOLUME 7 ISSUE 8 2021	
49	DESIGN AND CONTROLLING OF PROPOSED DIFFERENTIAL BOOST INVERTER BASED INDUCTION MOTOR DRIVE	Girija Bandgar, M.S.Aspalli.	Strad Research. ISSN: 0039-2049	VOLUME 8, ISSUE 9, 2021	
50	Direct Torque Control of Induction Motor with Reduced Torque Ripples using Space-Vector Modulation Scheme.	Priyadarshini, Geeta, M.S Aspalli.	Strad Research. ISSN: 0039-2049	VOLUME 8, ISSUE 11, 2021	
51	Direct Torque Control of Induction Motor with Reduced Torque Ripples.	Priyadarshini, Geeta, M.S Aspalli.	GRADIVA REVIEW JOURNAL ISSN NO : 0363-8057	VOLUME 7 ISSUE 8 2021	
52	Torque ripple reduction using model predictive torque control method for induction motor drive.	Shivani , Geeta , M.S Aspalli .	Strad Research. ISSN: 0039-2049	VOLUME 8, ISSUE 9, 2021	
53	Model Predictive Torque Control-Based Torque Ripple Reduction for Induction Motor Drive.	Shivani , Geeta , M.S Aspalli.	GRADIVA REVIEW JOURNAL ISSN NO : 0363-8057	VOLUME 7 ISSUE 8 2021	
54	Direct Torque Control of Three Phase Induction Motor Drive Using PI Controller and Fuzzy Logic.	Sagri Umera Parveen , M.S Aspalli .	Strad Research. ISSN: 0039-2049	VOLUME 8, ISSUE 9, 2021	
55	Fuzzy Logic Based Proportional Integral Tuning for DTC Of Three Phase	Sagri Umera Parveen , Geeta , M.S Aspalli.	GRADIVA REVIEW JOURNAL	VOLUME 7 ISSUE 8 2021	

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56	Direct Torque Control of a Three Phase Induction Motor Using Carrier Space Vector Pulse Width Modulation.	Sagri Saba Parveen , Geeta , M.S Aspalli.	Strad Research. ISSN: 0039-2049	VOLUME 8, ISSUE 9, 2021	
57	A Carrier Space Vector Pulse Width Modulation Based Direct Torque Control of Three Phase Induction Motor.	Sagri Saba Parveen, Geeta , M.S Aspalli.	GRADIVA REVIEW JOURNAL ISSN NO : 0363-8057	VOLUME 7 ISSUE 8 2021	
	INTERNATIONAL CONFERENCE PAPERS				
1	Performance analysis of Symmetrical Multistage Voltage Multipliers.	M.S.Aspalli, S.D. Hirekodi. P.V.Hunagund.	International Conference on Advances in Energy Conversion Technologies. (MIT, Manipal)	2010	
2	Z-Source Inverter for AC Drives.	M.S.Aspalli, O.B.Heddurshetti, P.V.Hunagund.	International Conference on Advances in Energy Conversion Technologies. (MIT, Manipal.)	2010	
3	Parasitic Assisted Phase-Modulated Converter with Synchronous Rectification.	M.S.Aspalli, P.V.Hunagund.	International Conference on Communication, Computation, Control and Nanotechnology. (BKIT, Bhalki)	2010	
4	Induction Motor V/F Control Method Capable of High Performance.	M.S.Aspalli, B.Sravan Kumar, P.V.Hunagund.	International Conference on Enhancement in Power Electronics and Controls. (PSG College of Technology, Coimbatore)	Nov-2011	
5	Design and Development of Filter for Three Phase Induction Motor Drive System.	M.S.Aspalli, Kruthika.N, P.V.Hunagund.	International Conference on Enhancement in Power Electronics and Controls. (PSG College of Technology, Coimbatore)	Nov-2011	
6	A New Induction Motor V/F control method using DSPIC30F5011.	M.S.Aspalli, P.V.Hunagund Jyoti.K	International Conference on Control System and Power Electronics. (ACEEE Published by Springer).	Dec-2012.	
7	Sinusoidal Pulse Width Modulation with Variable Carrier Synchronization for	M.S.Aspalli, Anil Wamanrao.	International Conference on Control	June-2009.	

	Multilevel Inverter Controllers.		Automation, Communication and Energy Conservation. (Kongu Engineering College, Erode)		
8	Estimation of Induction Motor Field Efficiency for Energy Audit and Management using Genetic Algorithm.	M.S.Aspalli, S.B.Shetagar, S.F.Kodad.	3rd International Conference on Sensing Technology, Tainan, Taiwan.	Nov-Dec- 2008.	
9	Impact of Power Electronics on Global Warming and environment.	M.S.Aspalli	102nd Indian Science Congress	Jan-2015.	
10	Speed Control of BLDC Motor with Four Switch Three Phase Inverter using Digital Signal Controller.	M.S.Aspalli, Farhat Mubeen Munshi, Savitri.L.Medegar.	IEEE International Conference on Power and Advanced Control Engineering. (BN MIT in Association with IEEE Power Society,Benglore)	Aug-2015.	
11	Study of AI and PI Controller using SVPWM Technique for Induction Motor Speed Control.	Sushma.J.Patil, M.S.Aspalli	IEEE International Conference on Electrical,Electronics Communication, Computer Technologies and Optimization Techniques. (GSSS Institute of Engineering,Mysore)	Dec-2017.	
12	Remote/Rural Area Lighting through Green Energy.	M.S.Aspalli.	106th Indian Science Congress.	Jan-2019	
13	Microcontroller 89C51 Controlled MOSFET Chopper for Speed Control of Three Phase Slip Ring Induction Motor Drive System.	A.D.Rajkumar, M.S.Aspalli Sanjeev Gogga	International Conference PEITSICON 2005.(IEEE Kolkata)	Jan-2005	
14	Microcontroller Based Speed Control of DC Shunt Motor using Fuzzy Logic.	H.G.Gopal, M.S.Aspalli, P.Pullaiiah.	National Conference on Power Electronics and Power Systems.	Feb-2006.	
15	Embedded Control of Z Source Inverter fed Induction Motor.	M.S.Aspalli, Swapna Kumari Karanam.	International Conference on Electrical Electronics and Computer Science.	April-2014.	
16	Performance of Induction Motor at starting with and without Soft Starter with Experimental Evaluation.	M.S.Aspalli, P.V.Hunagund.	National Conference on Antennas and its Applications.	Feb-2012.	
17	Soft Starter for a Three Phase Induction Motor.	M.S.Aspalli, P.V.Hunagund, Dimple Bapure.	National Conference on VLSI and Communication.(Oct-2012.	

			BIT, Bangalore)		
18	Z- Source Inverter fed Induction Motor Drive.	Hanumantha Reddy, M.S.Aspalli, P.V.Hunagund.	National Conference on Emerging Trends in Engineering and Management.	March-2013.	
19	Challenges in Retrofitting the Variable Speed Drives for the Refinery A Practical review.	Subrahmanya Bhat, M.S.Aspalli, S.Raveendranatha Prasad.	National Conference on Power Electronics and Variable Drives.	PEDC-2006.	
20	Remote/Rural Area Lighting through Green Energy.	M.S.Aspalli.	International Conference on Global Energy Transition Issues and Challenges.	May-2018.	
21	Proportional Resonant Controller For Semi Converter Three Phase VSI Fed Induction Motor Drive to Enhance Time Response	Geeta, M.S.Aspalli	2020International Conference on Power Electronics & IoT Applications in Renewable Energy and its Control (PARC) GLA University, Mathura, UP.India.	Feb 28-29, 2020	978-1-7281-6575-2/20/\$31.00 ©2020 IEEE
22	A Switched Capacitor Multilevel Inverter with Voltage Boosting Ability	Nitin kumar, M.S.Aspalli, Sushma Patil	International Conference on Distributed Computing, VLSI, Electrical Circuits and Robotics (2020 IEEE DISCOVER).	Oct 30-31,2020	978-1-7281-9885-9/20/\$31.00 ©2020 IEEE.