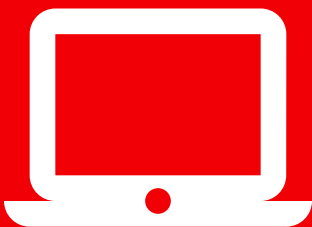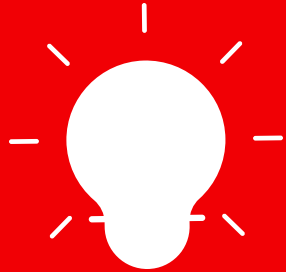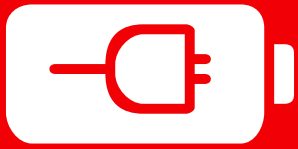# 15th Annual Graduate Research and Capstone Design Conference

GRC 2019

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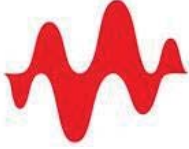
Graduate Research Presentations

UNIVERSITY of **HOUSTON** | ENGINEERING
Department of Electrical & Computer Engineering

15ᵗʰ Graduate Research Conference

April 26, 2019
The Hilton UH Hotel & Conference Center
Houston, Texas

8:30 - 8:55 am	Registration, Conrad N. Hilton, Lobby
8:50 - 8:55 am	Opening Remarks by Dr. Wanda Wosik, Plaza Room
8:55 - 10:05 am	Technical Program - Oral Session **A**, Plaza Room
10:05 -10:30 am	Welcoming Remarks, Plaza Room

- Dr. Badri Roysam, Chairman, Electrical and Computer Engineering
- Dr. Claudia Neuhauser Associate Vice President/Associate Vice Chancellor for Research and Technology Transfer
- Dr. Suresh Khator, Associate Dean, College of Engineering

10:30 - 10:45 am	Coffee Break, Conrad N. Hilton, Lobby
10:45- 11:50 am	Technical Program - Oral Session **B**, Plaza Room
11:55- 12:45 pm	Lunch, Waldorf-Astoria Ballroom
12:30 - 1:15 pm	Keynote Presentation: **"Engineers are from Mars, Students are from Neptune"** ***Dr. Douglas Verret***, IEEE Life Fellow, Chair of ECE Industry Advisory Board
1:15 - 2:20 pm	Technical Program - Oral Session **C**, Plaza Room
2:20 - 2:30 pm	*Coffee Break,* Conrad N. Hilton, Lobby
2:30 - 3:35 pm	Technical Program - Oral Session **D**, Plaza Room
3:35 - 5:30 pm	Technical Program - Poster Session, Conrad CD Ballroom
5:30 - 6:00 pm	Elevator Talks by CDC students, Conrad AB Ballroom
6:00 - 6:30 pm	Awards Ceremony, Conrad AB Ballroom

GRC 2019

The Hilton UH Hotel & Conference Center

April 26, 2019

8:30 – 8:55 am   Registration, Conrad N. Hilton, Lobby

8:50 – 8:55 am   **Opening Remarks in Plaza Room** by Dr. Wanda Wosik

TECHNICAL PROGRAM

Session A:
- **New Solutions for Power Supply, Transmission and Storage.**
- **Testing, Communication, and Control in Robotics and Prosthetics Including Biomedical Diagnostics and Treatment Methods.**

Session Type: Oral
Time: 8:55 – 10:05 am
Faculty Chair: Dr. Jose L. Contreras-Vidal

Poster #

8:55 – 9:00 am	**A DROOP BASED SOC CONTROL OF MODULAR MULTI-LEVEL CONVERTER FOR SOC BALANCING IN GRID ENERGY STORAGE** *Amir Hussain, Krishna Raj, and Kaushik Rajashekara*	A1
9:00 – 9:05 am	**A NOVEL *DROGI* BASED CONTROL ALGORITHM WITHOUT PLL FOR SHUNT COMPENSATION USING FOUR-LEG CONVERTER** *Shilei Jiao, Kaushik Rajashekara, and Krishna Raj R.*	A2
9:06 – 9:11 am	**MULTI–PHASE 3–LEVEL BUCK CONVERTER WITH CURRENT SELF -BALANCING FOR HIGH BANDWIDTH ENVELOPE TRACKING POWER SUPPLY** *Srikanth Yerra and Harish Krishnamoorthy*	A3
9:12 – 9:17 am	**POWER CYCLING TEST BENCH FOR ACCELERATED LIFE TESTING FOR RELIABILITY ASSESMENT OF SiC-MOSFET IN EXTREME OFFSHORE ENVIRONMENT** *Amin Sadat and Harish Krishnamoorthy*	A4
9:18 – 9:23 am	**UNDERWATER ROBOTICS COMMUNICATIONS** *Javier Garcia, Steban Soto, and Aaron Becker*	A5

9:24 – 9:29 am	**SURVIVABILITY OF DRONE SWARMS WITH FLOCKING AND SWARMING FLIGHT PATTERNS USING VIRTUAL REALITY** *Arun Mahadev, Daniel Biediger, and Aaron T. Becker*	A6
9:30 – 9:35 am	**DEVELOPMENT OF A LOW-COST 3D PRINTED MYOELECTRIC PROSTHETIC AREM: CASE STUDY OF A 7-YEAR OLD WITH CONGENITAL DEFICIENCY** *Alexander G. Steele, Akshay Ravindra, and Jose L. Contreras-Vidal*	A7
9:36 – 9:41 am	**USE OF SENSORIMOTOR LATERALIZATION-BASED MEASURES FOR MONITORING CHRONIC STROKE MOTOR RECOVERY** *Zachery R. Hernandez and Jose L. Contreras-Vidal*	A8
9:42 – 9:47 am	**CLASSIFICATION AND IDENTIFICATION OF ABNORMAL CILIARY MOVEMENT** *Alexander R. Craik, Ryan Thackston, Michelle Gale*, and *Jose L. Contreras-Vidal*	A9
9:48 – 9:53 am	**BAYESIAN FILTERING METHODS FOR TRACKING AROUSAL AND ENERGY** *Dilranjan S. Wickramasuriya and Rose T. Faghih*	A10
9:54 – 9:59 am	**STATE-SPACE MODELING AND FUZZY FEEDBACK CONTROL OF COGNITIVE STRESS** *Hamid Fekri Azgomi, Dilranjan S. Wickramasuriya , and Rose T. Faghih*	A11
10:00 –10:05 am	**PARALLEL SEMANTIC SEGMENTATION OF HIGH-THROUGHPUT IMAGING MOUSE BRAIN DATA** *Leila Saadatifard, Pavel Govyadinov, Aryan Mobiny, Guoning Chen, and David Mayerich*	A12
10:05 –10:30 am	**Welcoming Remarks and Addresses in Plaza Ballroom** • Dr. Badri Roysam, Chairman, Electrical and Computer Engineering • Dr. Claudia Neuhauser Associate Vice President/Associate Vice Chancellor for Research and Technology Transfer • Dr. Suresh Khator, Associate Dean, College of Engineering	
10:30 – 10:45 am	***Coffee Break,*** Conrad N. Hilton, Lobby	

Session B: Fabrication Methods, Design, and Characterization Methods for Materials, Devices, and Sensors.
Session Type: Oral
Time: 10:45 – 11:56 am
Faculty Chair: Dr. Stanko Brankovic

10:45 – 10:50 am	**FLEXIBLE MACROPOROUS ELECTRODES FOR METAL-OXIDE BASED ELECTRO-CHEMICAL SUPERCAPACITORS** *Sasidharan Prakasan, Rabi Ebrahim, Steven Pei, and Alex Ignatiev*	B1
10:51 – 10:56 am	**NOVEL POLYMER CATHODE FOR HIGH-CAPACITY AND LONG-CYCLE-LIFE AQUEOUS ZINC BATTERIES** *Ye Zhang and Yan Yao*	B2
10:57 – 11:02 am	**A NOVEL AQUEOUS-BASED SENSOR BY ENGINEERING CHEMI-RESISTIVITY OF AU THIN FILMS USING METAL DEPOSITION VIA SLRR** *Kamyar Ahmadi, Dongjun Wu, and Stanko R. Brankovic*	B3
11:03 – 11:08 am	**IN-SITU SURFACE REFLECTIVITY MEASUREMENT FOR ELECTROLESS ATOMIC LAYER DEPOSITION** *Dhaivat J. Solanki and Stanko R. Brankovic*	B4
11:09 – 11:14 am	**UNDERCUT GOLD NANODISKS IN AN ARRAY FOR PLASMONIC BIOSENSING** *Ibrahim Misbah and Wei-Chuan Shih*	B5
11:15 – 11:20 am	**SERS NANOPARTICLE-BASED LATERAL FLOW ASSAY FOR ULTRASENSITIVE, QUANTITATIVE DETECTION OF PROTEIN BIOMARKERS** *Dilani Gunawardhana, Katerina Kourentzi, Richard C. Willson, and Wei-Chuan Shih*	B6
11:21 – 11:26 am	**DEEP LEARNING FOR GLUCOSE SENSING BY STAMPING SURFACE-ENHANCED RAMAN SPECTROSCOPY (S-SERS)** *Chun-Jen Lin, Ibrahim Misbah, and Wei-Chuan Shih*	B7
11:27 – 11:32 am	**TIB$_2$ MICRO-PATTERNED SUBSTRATE FOR THE DIFFERENTIATION OF MESENCHYMAL STEM CELLS INTO INSULIN PRODUCING CELLS.** *Jefferson Friguglietti, Fatima A. Merchant, Wanda Wosik, and Daniel W. Fraga*	B8
11:33 – 11:38 am	**MULTIPLEX SENSING OF LEAD AND MERCURY IN DRINKING WATER USING SMARTPHONE NANO-COLORIMETRY** *Hoang Nguyen and Wei-Chuan Shih*	B9

11:39 – 11:44 am	**SELECTIVE PLASMONIC SUBSTRATE MODIFICATION VIA PHOTOTHERMALLY GENERATED MICROBUBBLES**	B10
	Nareg Ohannesian, Jingting Li, Ibrahim Misbah, Fusheng Zhao, and Wei-Chuan Shih	
11:45 – 11:50 am	**HOLOGRAPHIC OPTICAL TWEEZERS ASSISTED IMAGING SPECTROSCOPY**	B11
	Mohsen Rakhshandehroo and Wei-Chuan Shih	
11:51 – 11:56 am	**BROADBAND EMISSION ENHANCEMENT OF LEAD HALIDE PEROVSKITE CSPB2BR5 MICROPLATES UNDER HIGH PRESSURE**	B12
	Shenyu Dai, Zhaojun Qin, and Jiming Bao	
11:56 – 12:45 pm	**Lunch**, Waldorf Astoria, Ballroom	
12:30 – 1:15 pm	Keynote Presentation: **"Engineers are from Mars, Students are from Neptune"** *Dr. Douglas Verret,* IEEE Life Fellow, Chair of ECE Industry Advisory Board	

Session C: The *magic* of Imaging: from Hyperspectral Image Analyzes to Sub-Cellular and Physiological Recognition Techniques
Session Type: Oral
Time: 1:15 – 2:20 pm
Faculty Chair: Dr. David Mayerich

1:15 – 1:20 pm	**IMPROVING SPATIAL SPECIFICITY IN BROADBAND HYPERSPECTRAL IMAGES USING CURVELET-BASED IMAGE SHARPENING**	C1
	Rupali Mankar, Mahsa Lotfilohi, Saurabh Prasad, and David Mayerich	
1:21 – 1:26 pm	**A THEORETICAL FRAME WORK FOR CHEMICAL HOLOGRAPHY**	C2
	Shihao Ran, David Mayerich, and Rohith Reddy	
1:27 – 1:32 pm	**TIMING: HIGH-THROUGHPUT SINGLE-CELL PROFILING OF DYNAMIC CELL–CELL INTERACTIONS BY TIME-LAPSE IMAGING MICROSCOPY IN NANOWELL GRIDS**	C3
	Rachel Mills, Badrinath Roysam, Navin Varadarajan, and Hengyang Lu	
1:33 – 1:38 pm	**CELL SEGMENTATION IN SUPER-RESOLUTION MICROSCOPY USING LOCALIZATION-REINFORCED PERCEPTUAL GROUPING (LRPG)**	C4
	Jiabing Li, Camille Artur, Badrinath Roysam, and David Mayerich	

| 1:39 – 1:44 pm | **DIGITAL STAINING OF HIGH-RESOLUTION FTIR SPECTROSCOPIC IMAGES**
Mahsa Lotfollahi, Sebastian Berisha, Davar Daeinejad, and David Mayerich | C5 |

| 1:45 – 1:50 pm | **HIGH-THROUGHPUT THREE-DIMENSIONAL MICROSCOPY BY MILLING WITH ULTRAVIOLET EXCITATION (MUVE)**
Jiaming Guo, Camille Artur, Jason Eriksen, and David Mayerich | C6 |

| 1:51 – 1:56 pm | **HIGH RESOLUTION MID-INFRARED PHOTOTHERMAL IMAGING OF OVARIAN CANCER CELLS**
Chalapathi C Gajjela and Rohith Reddy | C7 |

| 1:57 – 2:02 pm | **ANALYSIS OF BONE DISORDER USING OPTICAL PHOTOTHERMAL INFRARED MICROSCOPY**
Licheng Zhang, Chalapathi Charan Gajjela, and Rohith Reddy | C8 |

| 2:03 – 2:08 pm | **MENTAL WORKLOAD CLASSIFICATION VIA HIERARCHICAL LATENT DICTIONARY LEARNING: A FUNCTIONAL NEAR INFRARED SPECTROSCOPY STUDY**
Srinidhi Parshi, Md. Rafiul Amin, Hamid Fekri Azgomi, and Rose T Faghih | C9 |

| 2:09 – 2:14 pm | **A SYSTEM THEORETIC INVESTIGATION OF CORTISOL DYSREGULATION IN FIBROMYALGIA PATIENTS WITH CHRONIC FATIGUE**
Divesh Deepak Pednekar, Md. Rafiul Amin, Hamid Fekri Azgomi, Kirstin Aschbacher, Leslie J. Crofford, and Rose T. Faghih | C10 |

| 2:15 – 2:20 pm | **INFERRING SYMPATHETIC NERVOUS SYSTEM ACTIVITY FROM ELECTRODERMAL ACTIVITY: A SPARSE SYSTEM IDENTIFICATION APPROACH**
Md. Rafiul Amin and Rose T. Faghih | C11 |

2:20 – 2:35 pm   *Coffee Break,* Conrad N. Hilton, Lobby

Session D: Numerical Optimization, Deep Learning, Electromagnetics and Electronics for Systems, Circuits and Sensors.
Session Type: Oral
Time: 2:35 – 3:40 pm
Faculty Chairs: Dr. David Jackson

2:35 – 2:40 pm	**GRAPH CONVOLUTIONAL NEURAL NETWORKS FOR HYPERSPECTRAL DATA CLASSIFICATION** *Farideh Foroozandeh Shahraki and Saurabh Prasad*	D1
2:41 – 2:46 pm	**MEMORY-CENTERED NEURAL COMPUTER ARCHITECTURE FOR DEEP LEARNING** *Yawen Luo, Aswini Kumar Tata, and Yuhua Chen*	D2
2:47 – 2:52 pm	**FIRST ARRIVAL PICKING USING U-NET WITH LOVASZ LOSS AND NEAREST POINT PICKING METHOD** *Pengyu Yuan, Wenyi Hu, Xuqing Wu, Jiefu Chen, and Hien Van Nguyen*	D3
2:53 – 2:58 pm	**SPARSE PCE SURROGATE ASSISTED INVERSION ALGORITHM FOR ULTRA-DEEP ELECTROMAGNETIC RESISTIVITY LOGGING-WHILE-DRILLING DATA** *Han Lu, Jiefu Chen, Xuqing Wu, Xin Fu, Mohammad Khalil, Cosmin Safta, and Yueqin Huang*	D4
2:59 – 3:04 pm	**A FAST MOM SOLVER FOR WIRE-TO-SURFACE JUNCTIONS IN LAYERED UNIAXIAL MEDIA** *Shubin Zeng, Donald R. Wilton, and Jiefu Chen*	D5
3:05 – 3:10 pm	**SIW MICROSTRIP CAVITY RESONATORS WITH A SENSING APERTURE** *Chaoxian Qi, David R. Jackson, Yan Yao, and Jiefu Chen*	D6
3:11 – 3:16 pm	**NO ONE LEFT BEHIND: AVOID DEATH IN HOT CARS VIA WIFI DETECTION** *Dian Shi, Jixiang Lu, and Miao Pan*	D7
3:17 – 3:22 pm	**SIW PATCH ANTENNA WITH LOSSY SUBSTRATE FOR NEAR-FIELD COMMUNICATION** *Muhammad I. Khan, David R. Jackson, and Chatwin Lansdowne*	D8
3:23 – 3:28 pm	**6-BIT 5 GS/S FLASH ASSISTANT TIME-INTERLEAVED SAR ADC IN 28 nm SOI CMOS** *Hao Deng, Qingjun Fan, and Jinghong Chen*	D9
3:29 – 3:34 pm	**A LOW-POWER SIPM READOUT FRONT-END WITH FAST PULSE GENERATION AND SUCCESSIVE-APPROXIMATION REGISTER ADC IN 0.18 μm CMOS** *Yuxuan Tang, Qingjun Fan, and Jinghong Chen*	D10

3:305 – 3:40 pm   **A K-BAND QUADRATURE FREQUENCY SYNTHESIZER WITH**   D11
                           < -64 dBc SPURS AND > 27.94% LOCKING RANGE FOR
                           MULTIBAND 5G mm-WAVE APPLICATIONS
                           Yulang Feng, Qingjun Fan, and Jinghong Chen

Session E: POSTER PRESENTATIONS
Time: 3:40 – 5:30 pm, Conrad CD Ballroom
All posters will match talks presented by the graduate students in oral sessions.

5:30– 6:00 pm   **Elevator Talks by CDC Students**, hosted by Dr. Len Trombetta,
                         Conrad AB Ballroom

6:00 – 6.30 pm   **Awards Ceremony and Reception**, Conrad AB Ballroom

Plenary Speaker: Douglas Verret, Ph.D.
"Engineers are from Mars, Students are from Neptune"

This talk is about the state of engineering education in the modern age and the challenges that educators and students will face in a dynamic and fast-changing environment. The global population of engineers has been growing for decades and is forecasted to continue through the next decade and beyond. Except for BSEEs this trend is evident in the US as well. The largest percentage growth of technical professionals has been outside North America and Western Europe. There will be a growing commoditization of technical professionals globally. The average length of a 'technical career' is diminishing, which increases the need for continuing education to prepare people for mid-career job shifts or simply to update people in their current jobs. *The need for and interest in technical information is increasing dramatically.*

There is increasing emphasis on conserving natural resources and on developing renewable energy sources as alternatives to oil and coal. There will be a continuing shift of world influence from present developed nations to developing nations. There will be a continuing "flattening" of the world as the internet allows people to be easily connected around the globe to conduct business. This will be especially true in areas of information and knowledge access *which will influence* business and *education competitiveness*. Centers of technology excellence (*e.g.* universities) have spread rapidly across the flat world.

There is a greater disconnect between individuals and employers. Engineering will continue to become more interdisciplinary. Employers are expecting immediate value contribution. Changing age demographics will pose a threat of knowledge loss as the "baby boom" generation's more experienced professionals retire. There will be a need to identify gaps in *practical knowledge* in transfer from one generation to the next.

Because of the ubiquity of mobile devices technical information is available pretty much anywhere at any time. Current boundaries between various disciplines, including science and technology are less distinguishable. There is greater activity in biological and medical systems and interaction with engineering. Many enterprises are awash in data of many different types at high velocity (2.5×10^{18} bytes/day[1]) and uncertain veracity, some needing rapid analysis. Public perception of the security of data is low. Everything that can be is being made "smart" via artificial intelligence.

Given this climate and the state of the profession, we will provide some perspectives about what this implies for engineering schools and their students, which challenges are present in the current university structure (cost, value, insularity, competition) that will have to be overcome or mitigated and what students will need to do to prepare for this environment beyond what is in the current curriculum. The perception of the student experience is often perceived by industry as "other worldly" as if students inhabit another planet. An attempt will be made to describe the "real world" environment of engineering practice in contrast with the orderly academic environment.

1. Bernard Marr, www.forbes.com/sites/bernardmarr/2018/05/21/how-much-data-do-we-create-every-day-the-mind-blowing-stats-everyone-should-read/#6d2f7aa160ba

Dr. Douglas Verret

IEEE Life Fellow
Texas Instruments Fellow Emeritus
Chairman of the *Industry Advisory Board* for the Department of Electrical and Computer Engineering.

Dr. Douglas Verret is a world recognized expert in microelectronics with lifetime achievements in the semiconductor industry···a physicist and an engineer in action to create better electronics. He was an architect and leader in developing many new generations of silicon devices and processes for electronic circuits and systems, since he first joined Texas Instruments Inc in 1979. Terms such as double-level metal (DLM) process for Low Power Schottky TTL devices, polysilicon emitter, deep trench isolation and planarized metal technologies in TI digital Bipolar and BiCMOS circuits and many others have now an important meaning as pioneering steps in the development and progress of microelectronics. The teams he led created numerous Integrated Circuits (ICs) still in use today and sold by companies such as Apple Computer, IBM, Intel, Bosch, Sirius XM and Delphi among others.

Dr. Verret's career in microelectronics includes multiple managerial positions at TI and also in SEMATECH, a consortium of fourteen US semiconductor companies and the US government residing in Austin TX where he was the Director of Manufacturing Techniques and Standards and developed their 0.5um CMOS technology. His most recent positions included Program Manager of 65nm eflash technology followed (in 2012) by Manager of TI's next generation embedded flash technology. The 65nm technology was the first and still is the only 65nm embedded flash technology in the automotive and safety markets.

Dr. Douglas Verret's contributions to science and technology are well recognized by his numerous editorial positions in IEEE journals and conferences, program and leadership committees and by his membership in truly many council and advisory, educational and science boards at several foundations, schools and universities. He holds sixteen patents.

He is married to Ellen Verret Ph.D., who is a psychologist in Fort Bend Independent School District and they are the proud parents of Sybil Lincecum Au.D and Laurence Verret, MBA, CPA. They are also the fawning grandparents of four granddaughters. In his spare time he is a student of comparative mythology and alternates between playing the guitar badly and the trumpet miserably.

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Thank you for joining us at the 2019 Graduate Research and Capstone Design Conference!