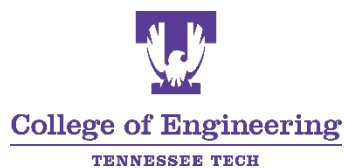


ANNUAL REPORT FY 2017—2018

Center for Manufacturing Research College of Engineering Tennessee Tech University



About the Cover

Engineering students utilize the resources of the 3-D printers in the iMakerSpace.

Center for Manufacturing Research

Tennessee Tech University
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Cookeville, TN 38505

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Tennessee Technological University Center for Manufacturing Research Annual Report – FY 2017 – 2018

Mission Statement (Unchanged since 2001)

“To advance and support scientific and engineering knowledge in areas related to manufacturing through fundamental research and technology transfer activities, and to impact the instructional program in those areas.”

The Center for Manufacturing Research (CMR) at TTU is a THEC Established Center of Excellence and has been since 1990.

Director

Vahid Motevalli, Ph.D., P.E.
Interim Director
Center for Manufacturing Research
Associate Dean for Research & Innovation
College of Engineering

Dr. Ying Zhang, Ph.D. was appointed Director of the CMR effective July 1, 2018.

Ying Zhang, Ph.D.
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CMR Faculty and Staff

Dr. Robert Qiu, Professor, ECE
Dr. Cynthia Rice, Assoc. Prof., ChE
Dr. Kwun-Lon Ting, Professor, ME

Brian Bates, R&D Engineer I
Michelle Davis, Outreach Coordinator
Dr. Nan (Terry) Guo, R&D Engineer III
E. Wayne Hawkins, Material Science Lab Manager
Suzanne Henry, Center Manager
Tammy Martin, Administrative Associate III (part-time, temporary)
Robert Matthews, R&D Engineer I (part-time, temporary)
Anysa Milum, Financial Associate VI
Garrett Perry, R&D Engineer I (part-time, temporary - 11 months)
Rob Reab, IT Systems Administrator (part-time, temporary – July–Dec 2017)
Phyllis Stallion, Administrative Associate V
Darlene Wiegand, Financial Analyst (part-time, temporary)

CMR Faculty Associates

Dr. Adam Anderson, Joint Faculty with the ORNL
Dr. Stephen Anton, Asst. Professor, ME
Dr. Curtis P. Armstrong, Chair, Professor, Decision Sciences & Mgt.
Dr. Joe J. Biernacki, Professor, ChE
Dr. Stephen Canfield, Professor, ME
Dr. Pinggen Chen, Asst. Professor, ME
Dr. Glenn Cunningham, Assoc. Professor, ME
Dr. William Eberle, Professor, CS
Dr. Ahmed EISawy, Chair, Professor, MET
Dr. Ismail Fidan, Professor, MET
Dr. Melissa J. Geist, Assoc. Professor, Nursing
Dr. Sheikh Ghafoor, Assoc. Professor, CS
Dr. Syed Rafay Hasan, Asst. Professor, ECE
Dr. Stephen A. Iden, Professor, ME
Dr. Wayne Johnson, Chair, Professor, ECE
Dr. DuckBong Kim, Asst. Professor, MET
Dr. Ethan Languri, Asst. Professor, ME
Dr. ChaBum Lee, Asst. Professor, ME
Dr. Satish Mahajan, Professor, ECE/Director, CESR
Dr. Mohamed Mahmoud, Asst. Professor, ECE
Dr. Vahid Motevalli, Assoc. Dean of Research and Innovation, College of Engineering; Professor, ME
Dr. Mohammad Rahman, Asst. Professor, CS
Dr. Mohan Rao, Chair, Professor, ME
Dr. Jonathan (Robby) Sanders, Asst. Professor, ChE
Dr. Ambareen Siraj, Professor, CS
Dr. Holly Stretz, Assoc. Professor, ChE
Dr. Meenakshi Sundaram, Professor, ME
Dr. Doug Talbert, Assoc. Professor, CS
Dr. Chris Wilson, Assoc. Professor, ME
Dr. Dale Wilson, Professor, ME
Dr. Liqun "Laura" Zhang, Asst. Professor, ChE
Dr. Ying Zhang, Professor, ME
Dr. Yunbo (Will) Zhang, Asst. Professor, ME
Dr. John Zhu, Professor, ME

EXECUTIVE SUMMARY

The Center for Manufacturing Research (CMR) had another very successful year due to the continuous efforts made by many outstanding faculty associates.

In FY17-18, forty-seven proposals in the amount of \$12,788,866 were submitted. The Center secured thirty-four projects from various external funding agencies, including U.S. Department of Energy, National Science Foundation, National Institute of Health, National Institute of Standards and Technology, Air Force Office of Scientific Research, and Oak Ridge National Laboratory. The total activated funding was \$2,981,089, the fourth highest amount of external funding since the Center's inception in 1984.

As a state-funded Center of Excellence, the CMR strives to support and enhance Tennessee manufacturing. As an example, the Industrial Assessment Center (IAC) with the CMR, led by Dr. Glenn Cunningham and Dr. Ethan Languri (faculty associates in Mechanical Engineering), continued to assist small- and medium-sized manufacturers in saving energy and reducing waste. Due to its significant contribution, the IAC was awarded the 2018 Center of Excellence by the U.S. Department of Energy, which places the IAC as the top-ranking center out of 28 such centers nationwide.

The CMR's dedication to improving manufacturing-related education resulted in 20 students receiving their advanced degrees this year (six Ph.D. and fourteen M.S. degrees, respectively). The CMR supported a total of 46 graduate students last year, 25 Ph.D. and 21 M.S. students. This accomplishment was only possible with the revenues provided from the State appropriations and externally funded grants that were designated for graduate student support.

Center Research Areas

The CMR focuses on several research, education and outreach areas:

Advanced Manufacturing focuses on improving manufacturing processes and methodology through the innovative application of technologies to product design and production.

Materials for Energy Storage and Conversion addresses the need to develop the material for next generation of energy storage/conversion devices and energy efficiency technologies.

Networking and Algorithms for Big Data offers changing opportunities to assist advanced manufacturing in use of sensors and automation in large networks and Big Data in manufacturing processes.

Industry Support provides Tennessee manufacturers with technical expertise in problem-solving challenges faced in materials, design, testing, and processes.

Education and Outreach efforts enhance the Tennessee workforce development and outreach in the CMR's research areas in addition to such other activities as energy efficiency, waste reduction, and productivity improvements.

Table 1. Activated Grants by Research Areas

Strategic Research Area	Activated Amount
Advanced Manufacturing	\$1,005,973
Materials for Energy Storage and Conversion	\$209,738
Networking and Algorithms for Big Data	\$53,578
Tennessee Industry Support	\$576,331
Education and Outreach	\$872,908
Other	\$262,561
Total	\$2,981,089

Selected Highlights from FY 2017 – 2018

External Funding Highlights

Thirty-four different research projects were funded for a total of \$2,981,089 from various funding agencies (i.e., U.S. Department of Energy, National Science Foundation, National Institute of Health, National Institute of Standards and Technology, Air Force Office of Scientific Research, and Oak Ridge National Laboratory). This is the fourth highest year of external funding since the center's inception in 1984.

CMR's new matching funds for the past FY were \$2,453,488. This amount excludes \$541,251 of indirect costs associated with this year's funded projects.

Forty-seven research proposals were submitted by CMR faculty and faculty associates in the past FY. The dollar value decreased by 21% from last year with a total value of \$12,788,866 submitted.

CMR supported 46 graduate students during the past FY. Twenty-one M.S. students and 25 Ph.D. students were funded from both State appropriations and grants received by faculty. Specifically, external grants funded 17 of the M.S. students and 14 of the Ph.D. students. Thus, 67% of CMR graduate students supported was from external funding. Among the graduate students funded by CMR, two M.S. and five Ph.D. students were from underrepresented minorities.

CMR supported a total of 53 undergraduate students during this past fiscal year from both State Appropriations and externally funded projects.

Table 2. Summary of CMR Accomplishments

	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18
Value of Proposals Submitted	\$9,387,001	\$12,179,250	\$21,117,542	\$16,175,678	\$12,788,866
Number of Proposals Submitted	34	51	59	58	47
Total External Activations	\$1,711,145	\$2,403,677	\$2,896,320	\$3,782,809	\$2,981,089
Number of Graduate Students Supported	20	32	55	55	46
Number of Undergraduate Students Supported	37	54	67	69	53

CMR continues to invest in new faculty with a manufacturing focus hired into the College of Engineering. As a result of this investment, 19 proposals for external funding were submitted by new faculty members in the Departments of Chemical, Electrical and Computer, and Mechanical Engineering.

CMR increased the percentage of graduate research assistant funding from external sponsors to 74% as shown in Table 3 below. Table 3 provides a summary of various sources of external revenues for the past five years that were used to “release” or “free up” State appropriations for other strategic investment areas. It is the CMR’s goal to continue to increase the amount of income (resources), both internally and externally, that can be used to expand research in the Center’s research focus areas as described on page 4.

Table 3. Salary and Supplies Released by External Funding

Performance Metric	FY 2013-14	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18
CMR Faculty and staff release time	\$83,621	\$99,224	\$128,231	\$142,801	\$101,464
Graduate student stipend and fees from external sponsors	\$265,734	\$325,719	\$282,994	\$481,254	\$428,579
Percentage of GRA support funding from external sponsors	63%	65%	45%	60%	74%
Total "Soft Money" (F&A return, testing income, GRA support, equipment usage, and release time)	\$457,172	\$558,390	\$552,393	\$796,950	\$614,388

Personnel Highlights



Dr. Vahid Motevalli, Associate Dean for Research and Innovation in TTU's College of Engineering, served as the CMR's Interim Director. This appointment was in addition to his regular duties as Associate Dean.

A search for a Center Director was launched in 2016-17. Dr. Ying Zhang was selected as CMR Director and officially started in this position beginning July 1, 2018. Dr. Zhang retains her tenured position and rank in the Mechanical Engineering Department.





Dr. Stephen Canfield, Professor of Mechanical Engineering, has continued to serve as Faculty Associate Director. In this role, Dr. Canfield is the Strategic Research Area (SRA) Coordinator for Advanced Manufacturing and has encouraged existing CMR faculty to work with other colleagues in this area, seek collaboration with faculty in other SRAs and develop teams to respond to funding opportunities. This is a partial appointment while Dr. Canfield continues his activities as Professor of Mechanical Engineering.

Research Highlights

CMR Faculty Associate Dr. Ambareen Siraj continues to serve as PI for the Tennessee CyberCorps: Scholarship for Service Program with Drs. Mohammad Rahman and Douglas Talbert serving as Co-PI's. Additional funding is expected for the continuation of this effort. NSF provided additional funding of this Cybersecurity Program by awarding two separate supplemental components: 1) Bootcamp Funding Supplement for \$50,973 and 2) Community College Inclusion for \$176,158. Dr. Siraj was also awarded second-year funding from the National Security Agency for \$123,245 for GenCyber Camp during the summer of 2018. This combined funding for Cybersecurity research continues to make Tennessee Tech one of the highly visible cyber defense education programs in the country as well as designation by both NSA and the Department of Homeland Security (DHS) as a National Center of Academic Excellence in Cyber Defense Education (CAE-CD) through AY 2021.



CMR continued to support the iMakerSpace. The iMakerSpace was established as a University-wide center under the leadership of the Colleges of Engineering and Business. It is a focal point on campus to provide training, service, partnership, research and evaluation in Innovation and Entrepreneurship to all disciplines. iMakerSpace encourages interdisciplinary teams and provides support and training to extend I&E activities into research and the classroom. CMR R&D Engineer, Dr. Terry Guo has been released from part of his duties in the CMR to support the activities in the iMakerSpace.



The National Science Foundation awarded CMR Faculty Associates, Dr. Mohamed Mahmoud and Dr. Syed Hasan \$121,103 for Year 3 to host a Research Experiences for Undergraduates (REU) Site - Secure and Privacy Preserving Cyber Physical Systems at



Tennessee Tech this summer for a ten-week period. This REU Program will focus on research related to security and privacy preservation in Smart Cities infrastructures, including smart power grid and smart traffic management, and will provide undergraduate research experiences for a total of ten interns from ten different universities.

The fifth annual Women in Cybersecurity Conference held in Chicago, Illinois in March 2018 was led by Dr. Ambareen Siraj, CMR Faculty Associate. Cybersecurity students from Tennessee Tech as well as students from other universities such as Georgia Tech, University of Washington, and the Institutions of Carnegie Mellon University attended the conference. The conference registered 1100 participants in attendance.



Fifth Annual Women in CyberSecurity Conference, March 2018, Chicago, IL

Dr. Ismail Fidan, CMR Faculty Associate, continued in the second year of a three year NSF grant entitled “AM-WATCH: Additive Manufacturing – Workforce Advancement Training Coalition and Hub”. The primary goal of AM-WATCH is to bridge the gap between industry needs and future workforce skills via the enhancement of high school and community college curriculum with Additive Manufacturing Practices. This is accomplished through the development of curriculum and the delivery of professional development.



The CMR recruited two new Visiting International Researchers to Tennessee Tech during 2017-18 for the Center’s Wireless Communications/Networking Systems Research Group.

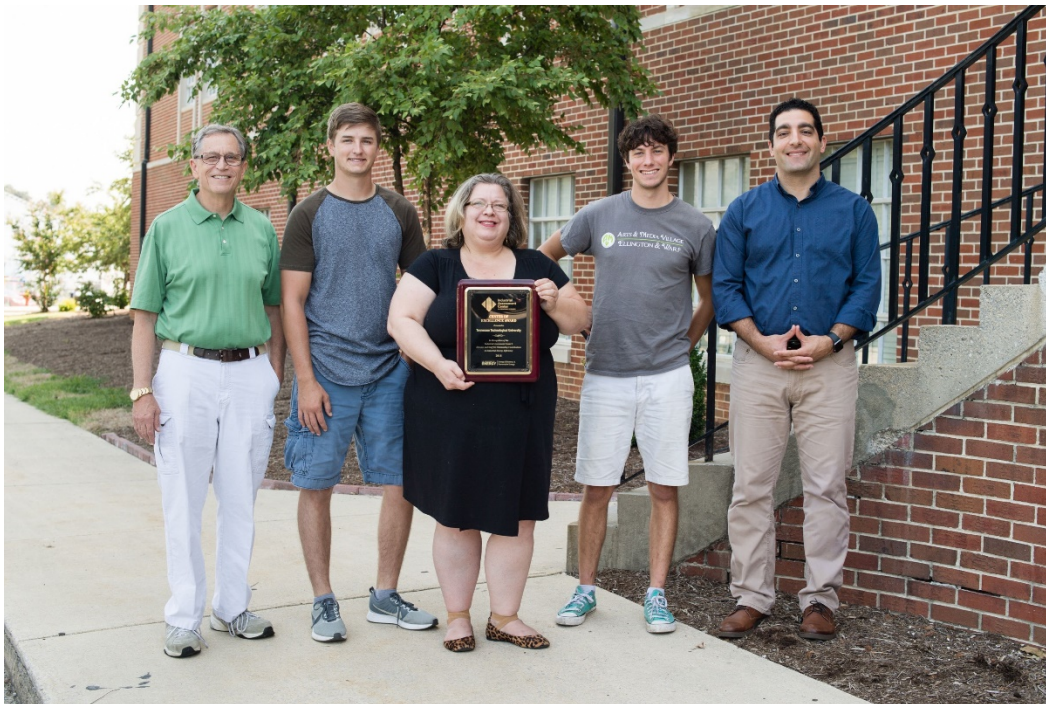
A CAPSTONE grant funded for \$15,000 was awarded from UT/CIS again in 2017-2018. This grant will allow students the opportunity to correlate their innovative ideas with various industries in a classroom environment.

Center Activities

Tennessee Three-Star Industrial Assessment Center

The Tennessee 3-Star Industrial Assessment Center (IAC) received an award of \$471,321 from the U.S. Department of Energy (DOE) to continue the IAC that was established in the CMR in 2006. The mission of the IAC is two-fold: 1) Assist small to medium sized manufacturers to become more energy efficient, and 2) Instruct engineering students in best practices of industrial energy efficiency to prepare them for the workforce. In twelve years, 211 assessments have been performed by the students and faculty for companies of all sizes and industries in and around Tennessee, with total implemented savings of \$8.5 million. One hundred and fifty-nine students have participated in the IAC with 55 receiving DOE certification in the program. This past year, the IAC began offering additional services such as water and wastewater assessments, consulting in Smart Manufacturing, ISO 50001 energy management systems, and cybersecurity assessments in collaboration with the Cybersecurity Education, Research, and Outreach Center (CEROC) at Tennessee Tech.

The IAC was honored by the DOE with the 2018 Center of Excellence Award, naming TTU's IAC as the center of the year from among 28 centers.



Glenn Cunningham (Director), Kade Howard (undergraduate, ME), Michelle Davis (Coordinator), Josh Daughtery (undergraduate, ME), Ethan Languri (Associate Director)

The IAC contracted with the Tennessee Valley Authority (TVA) to provide assistance to them in achieving certification to the ISO 50001 Energy Management Standard for their Magnolia Combined Cycle Power Plant in Mississippi. This will be the first power plant in the country certified to this rigorous standard.

Seminar Presentations

Golden Eagle Additively Innovative Virtual Lecture Series

Workflow of the Additive Manufacturing Process, Kyle Bates-Green, National Resource Center for Materials Technology Education

3-D Printing, Design Thinking, and the Entrepreneurial Mindset, Phan Tran, Lake Washington Institute of Technology

Using 3-D Printed Parts to Couple Festo Didatic's MecLab Stations in an Assembly Process, Khalid Tantawi, Motlow State University

Next Generation Manufacturing: Professional and Technical Skills for the 21st Century Workplace, Karen Wosczyzna-Birch, Center for Next Generation Manufacturing

Wire + Arc Additive Manufacturing: Enabling 10-Meter Metal Parts, Filomeno Martina, Cranfield University

Free and Easy Software for Designing for 3-D Printing, Timothy Gornet, University of Louisville

AM Research and Applications for Real World Production and Impact, Eric Wooldridge, Somerset Community College

Dental 3-D Printing Overview, Frank Alifui-Segbaya, Griffith University

CMR Student Lightning Round Seminar Series

Fall 2017

Effect of Fiber Orientation in Fatigue Properties of FRAM Components, Astrit Imeri, ME

The Catalytic Activity and Durability of Pt-based Catalysts for Oxygen Reduction Reaction in PEMFC, Gholamreza Mirshekari, ChE

Lean-burn Gasoline Engine Coupled with a Passive Selective Catalytic Reduction System, Qinghua Lin, ME

Efficiency Analysis of a Chiller Plant, Ryan Burns, ME

Spring 2018

Synthesis and Characterization of NiFe₃O₄-based Spinel for Solid Oxide Fuel Cell (SOFC) Cathode-side Contact Application, Yutian Yu, ME

The Effect of Minor Dopants on the Electrical and Physical Properties of Nickel Iron Spinel, David Chesson, ME

Investigating the Use of Impedance-based Structural Health Monitoring in Cemented Orthopedic Implants, Robert Ponder, ME

Improved Freeform Measurement through Fiber-based Metrology, Omid Zargar, ME

Electronic Cooling Using Diamond Nanofluid, Farzin Mashali, ME

FEA Modeling of Solder Joints in Electronic Circuit Board Components Exposed to Cryogenic Thermal Cycling, Jonathan Chappell, ME

Determination of Stress-Strain Curves of Eutectic Sn/Pb Solder at Cryogenic Temperatures using Indention Methods, Nick Russell, ME

Eigenvalue-based Detection Method for Cognitive Radio in Low SNR Environment, Qing Feng, ECE

Belt Testing, William Alston, ME

Visiting Scholars

The following visiting international researchers participated in CMR research activities this past year.

- Dr. Yuliang Zhang and Dr. Lin Zheng were members of Dr. Robert Qiu's Wireless Communications/Networking Systems Research Group in 2017-2018 to pursue research in Big Data Using Large Random Matrices Theory and Signal Processing.

Faculty, Staff and Student Accomplishments and Awards



CMR Faculty Associate, **Dr. Mohamed Mahmoud** (Assistant Professor of Electrical and Computer Engineering) was awarded the Brown-Henderson Outstanding Engineering Faculty Award which rewards accomplishments that most closely reflect the mission of the College of Engineering, to prepare graduates through a blend of education, research and service.

Dr. Mahmoud was also awarded the Kinslow Engineering Research Award which is given for the best paper written by a TTU engineering faculty member and published in a refereed professional journal.

Dr. Joseph Biernacki (Professor of Chemical Engineering), CMR Faculty Associate, was awarded the highest faculty honor, the 2018 Caplenor Faculty Research Award.



CMR Faculty Associate, **Dr. Ambareen Siraj** (Director of CEROC), was selected as Cybersecurity Fellow by the Cybersecurity Initiative of the New America.

Dr. Siraj also received the 2018 Academic Leadership of the Year Educator Award from the Colloquium for Information Systems Security Education.

CMR-supported Mechanical Engineering graduate student **Farzin Mashali** won the M.E. Graduate section of the Tennessee Tech Research and Creative Inquiry Day with his paper titled “Thermal Management Using Diamond Nanofluid”.



CMR-supported Mechanical Engineering graduate student **Mohsen Safaei** won the Best Student Hardware Paper Competition and was runner-up for the Best Student Paper Competition at the 2017 ASME Smart Materials Adaptive Structures and Intelligent Systems Conference.

Publications of CMR Faculty & Staff

Brian Bates

Journal Publications

1. Y.T. Yu, J.H. Zhu, and B.L. Bates, "Effect of Precursor Materials on the Performance of the NiFe₂O₄-Based Spinel Layer for SOFC Cathode-Side Contact Application", *Solid State Ionics*, 324, p. 40, June 2018.
2. Kamali, S., Bringas, E., Hah, H. Y., Bates, B., Johnson, J. A., Johnson C. E., Stroeve, P., "Magnetism and Mössbauer Study of Formation of γ -Fe₂O₃-based Core-Shell Nanoparticles," *Journal of Magnetism and Magnetic Materials*, Vol. 451, pp. 131-136, April 2018.

Terry Guo

Journal Publications

1. Bo Wang, Fengye Hu, Yanping Zhao, and Terry N. Guo, "Anomaly Detection and Array Diagnosis in Wireless Networks with Multiple Antennas: Framework, Challenges and Tools", *IEEE Network*, Dec. 2017.
2. Marbin Pazos-Revilla, Ahmad Alsharif, Surya Gunukula, Terry Guo, Mohamed Mahmoud, and Xuemin Shen, "Secure Privacy Preserving and Physical Layer Assisted (SecPPPLA) Dynamic Charging System for Electric Vehicles", *IEEE Transactions on Vehicular Technology*, Jan. 2018.

Conference Publications

1. T. Guo, D. Khoo, M. Coultis, M. Pazos-Revilla and A. Siraj, "IoT Platform for Engineering Education and Research (IoT PEER)–Applications in Secure and Smart Manufacturing", *ACM/IEEE International Conference on Internet of Things Design and Implementation (IoTDI)*, Orlando, FL, 17-20 April 2018.

Robert Qiu

Journal Publications

1. Y. H. Zhang, R. C. Qiu, X. He, Z. N. Ling, and X. Shi, "A Short-term Load Forecasting Based on Lstm Neural Network", *ELECTRIC POWER ICT (in Chinese)*, 2017.
2. X. He, Q. Ai, R.C. Qiu, J. Zhang, and X. Y. Xu, "A Primary Study on the Situation Awareness of Power Systems Using Random Matrix Theory", *Power System Technology (in Chinese)*, Vol. 41, No 4, pp. 11651173, 2017.
3. X. Xu, X. He, Q. Ai, and R.C. Qiu, "A Correlation Analysis Method for Power Systems Based on Random Matrix Theory", *IEEE Trans. Smart Grid*, Vol. 8, No. 4, pp. 1811-1820, July 2017.

Cynthia Rice

Journal Publications

1. G. Mirshekari, C.A. Rice, "Effects of Support Particle Size and Pt Content on Catalytic Activity and Durability of Pt/TiO₂ Catalyst for Oxygen Reduction Reaction in Proton Exchange Membrane Fuel Cells Environment", Journal of Power Sources, Accepted for publication.

Technical Presentations

Electrochemical Society-National Harbor, VA. October 2017

1. C.A. Rice, J. Cardenas, K. Pemberton, S. Saeed, Direct Formic Acid Fuel Cells Optimization: Flow Fields and Catalysts, Oral.
2. K. Pemberton, D. Dockery, G. Mirshekari, C.A. Rice, Improved Catalyst For Formic Acid Fuel Cells, Poster.
3. G. Mirshekari, P. Shirvanian, C.A. Rice, Electrochemical Behavior of Manganese Oxide Nanoparticles for Oxygen Reduction Reaction Environment in PEM Fuel Cells, Oral.
4. G. Mirshekari, P. Shirvanian, C.A. Rice, Catalytic Activity and Durability of Platinum Supported on Titanium Oxide Nanoparticles for Proton Exchange Membrane Fuel Cells, Oral.

Kwun-Lon Ting

Journal Publications

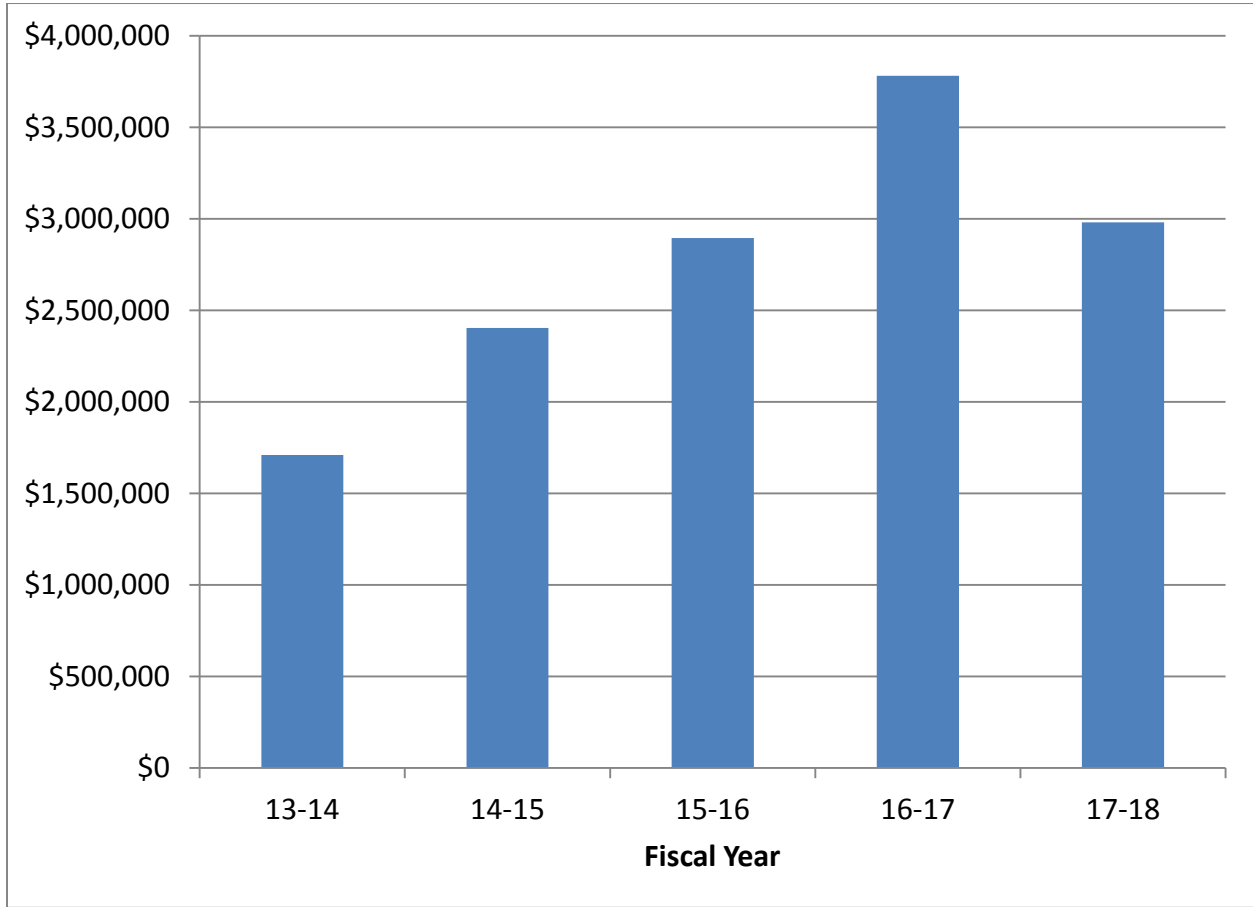
1. K.L. Ting, K.L. Hsu, and J. Wang, "Clearance-Induced Position Uncertainty of Linkages and Parallel Manipulators", Journal of Mechanisms and Robotics, Vol.9, No. 6, pp. 061001, September 6, 2017.
2. K.L. Hsu and K.L. Ting, Over-Constrained Mechanisms Derived from RPRP Loops, ASME Journal of Mechanical Design, Accepted for publication.

Conference Publications

1. K.L. Ting and Yu Zhiyuan, "Conjugation Curvature Theory of Higher Pairs", Paper No. DETC2017-68285, pp. V05BT08A082; 10 pages, doi:10.1115/DETC2017-68285
2. K.L. Ting, K.L. Hsu, L.I. Wu, and J. Wang, "A Modular Method for Manufacturing Error Analysis of Linkages and Manipulators", ASME 2017 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2017), Paper No. 68163
3. Yu Zhiyuan and K.L. Ting, "Planar Tooth Profile Synthesis for Relative Curvature", ASME 2017 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2017), Paper No. 67644

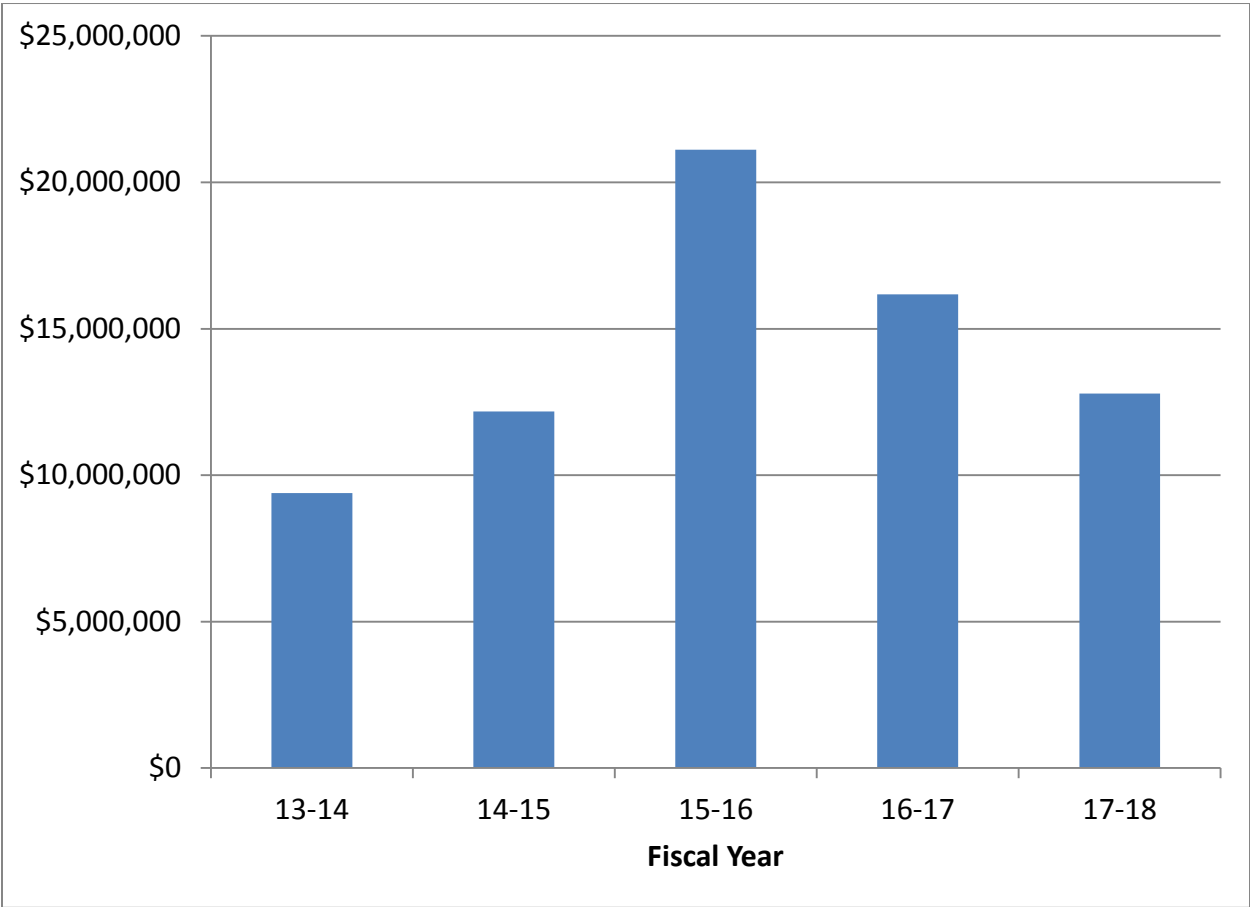
4. K.L. Ting and K.L. Hsu, "Clearance-Induced Position Uncertainty of Planar Linkages and Parallel Manipulators", ASME 2017 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2017), Paper No. 67203
5. Zetao Yu, L. Young, and K.L. Ting, "Formulating Assembly Procedures While Developing Complicate Products a Review for the State-of-the-art Technology", ASME 2017 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2017), Paper No. 67661
6. Jun Wang and K.L. Ting, "Equivalent Five-bar Linkages for the Singularity Analysis of Two-DOF Seven-bar Planar Linkages", ASME 2017 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2017), Paper No. 67527
7. J. Ren, J. Wang, and K.L. Ting, "Correction of Multiple Transducers Masses Effects From the Measured FRFs", ASME 2017 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2017), Paper No. 67516
8. Kejia Niu, Jun Wang^{1,a}, Kwun-Lon Ting^{2,b}, Fen Tao, Qunchao Cheng, Quan Wang, Kaiyang Zhang. Output Error Analysis of Planar 2-DOF Five-bar Mechanism, 2017 the 5th International Conference on Mechanical Engineering, Materials Science and Civil Engineering.

External Activations



FY	13-14	14-15	15-16	16-17	17-18
■ External Activations	\$1,711,145	\$2,403,677	\$2,896,320	\$3,782,809	\$2,981,089

Proposals Submitted



FY	13-14	14-15	15-16	16-17	17-18
■ Proposals Submitted	\$9,387,001	\$12,179,250	\$21,117,542	\$16,175,678	\$12,788.866

Grants and Contract Awards

Project/Source/Account Number	Principal Investigators	Amount	Beginning	Ending	Estimated - 12 months
1 CMR Testing and Design - 2017-2018 Various Industries Account #: 5-38585	Vahid Motevalli	\$70,010	7/1/2017	6/30/2018	\$66,684
2 UT-CIS Contract (2017-2018) The University of Tennessee Center for Industrial Services Account #: 5-33507	Meenakshi Sundaram	\$20,000	7/1/2017	6/30/2018	\$0
3 UT-CIS Contract (2017-2018) CAPSTONE The University of Tennessee Center for Industrial Services Account #: 5-33508	Meenakshi Sundaram	\$15,000	7/1/2017	6/30/2018	\$7,162
4 Program Income - Fiscal Year 2017-18 - on NSF WiCyS Conference - TTU Index 5-31273 National Science Foundation Account #: 5-31274	Ambareen Siraj	\$456,000	7/1/2017	6/30/2018	\$456,000
5 Advancement of Cryogenic Electronics MIT Lincoln Laboratory - Contract PO 7000293007 - Modification #7 Account #: 5-39376	Wayne Johnson Satish Mahajan	\$249,498	11/1/2016	12/31/2017	\$249,498
6 Idea to Commercially - Viable Healthcare Solutions: Enhancement and Expansion of Clinical Immersion at Disciplinary Interfaces Course Venturewell - Year 3 of 3 Account #: 5-35235	Robby Sanders Melissa Geist	\$5,000	8/1/2017	12/31/2018	\$5,000
7 Self-Powered In Vivo Force and Implant Wear Sensing in Knee Arthroplasty National Institute of Health - Award - IR15AR068663-01A1 - Year 2 of 3 Account #: 5-31307	Steven Anton	\$135,554	8/15/2017	8/14/2018	\$135,554
8 REU Site: Secure and Privacy-Preserving Cyber Physical Systems National Science Foundation - Award 1560434 - Year 3 of 3 Account #: 5-31263	Mohamed Mahmoud Syed Hasan	\$121,103	3/1/2018	2/28/2019	\$121,103
9 Supplement to: Tennessee Cybercorps: A Hybrid Program in Cybersecurity - for TTU Cyber National Science Foundation - Award 1565562 Bootcamp Supplement Year 2 Account #: 5-31279	Ambareen Siraj Doug Talbert	\$33,132	7/1/2017	6/30/2018	\$33,132

Project/Source/Account Number	Principal Investigators	Amount	Beginning	Ending	Estimated - 12 months
10 Supplement to TENNESSEE CYBERCORPS: A HYBRID PROGRAM IN CYBERSECURITY-Community College Inclusion National Science Foundation - Award 1565562 Account #: 5-31279	Ambareen Siraj Doug Talbert	\$35,689	8/18/2017	9/19/2018	\$35,689
11 AM-WATCH: Additive Manufacturing -Workforce Advancement Training Coalition and Hub National Science Foundation Account #: 5-31289	Ismail Fidan	\$310,759	8/1/2017	7/31/2018	\$310,759
12 Continuous Real-Time State Monitoring in Highly Dynamic Environments Air Force Office of Scientific Research - Award FA9550-16-1-0440 - Year 2 of 3 Account #: 5-32347	Steven Anton	\$120,000	9/1/2017	8/31/2018	\$120,000
13 NeTS: Small: Collaborative Research: Towards Privacy Preserving Autonomous Vehicle Sharing Services National Science Foundation Account #: 5-31290	Mohamed Mahmoud	\$53,578	9/1/2017	8/31/2018	\$18,528
14 Public-Private Partnership to Promote Efficient Manufacturing and Workforce Development Department of Energy, Office of Energy Efficiency and Renewable Energy - Account #: 5-32278	Glenn Cunningham Ethan Languri	\$149,647	9/1/2016	8/31/2017	\$149,647
15 Public-Private Partnership to Promote Efficient Manufacturing and Workforce Development Department of Energy, Office of Energy Efficiency and Renewable Energy - Account #: 5-32278	Glenn Cunningham Ethan Languri	\$6,675	9/1/2016	8/31/2017	\$6,675
16 Public-Private Partnership to Promote Efficient Manufacturing and Workforce Development Department of Energy, Office of Energy Efficiency and Renewable Energy - Award Account #: 5-32278	Glenn Cunningham Ethan Languri	\$65,000	10/10/2017	9/30/2018	\$65,000
17 Public-Private Partnership to Promote Efficient Manufacturing and Workforce Development Department of Energy, Office of Energy Efficiency and Renewable Energy - Award Account #: 5-32278	Glenn Cunningham Ethan Languri	\$249,999	9/1/2017	8/31/2018	\$104,586
18 Collaborative Research: Improved Freeform Measurement through Fiber-based Metrology National Science Foundation - Year 2 of 3 - Award 1663210 Account #: 5-31281	ChaBum Lee	\$62,136	4/15/2018	4/14/2019	\$62,136

Project/Source/Account Number	Principal Investigators	Amount	Beginning	Ending	Estimated - 12 months
19 Low Cost Corrosion and Oxidation Resistance Coatings for Improved System Reliability Faraday Technology, Inc. Account #: 5-32436	Ying Zhang	\$32,980	7/19/2017	12/1/2017	\$32,980
20 Decoupling Observer Design for NOx Sensor in Selective Catalytic Reduction System Applications. Cummins Technical Center - IND3981517 Account #: 5-35200	Pingen Chen	\$54,877	8/15/2017	5/31/2018	\$54,877
21 Supplement to Tennessee Cybercorps: A Hybrid Program In Cybersecurity - Community College Inclusion - 2017-2018 National Science Foundation - Award 1565562 - Year 1 of 3 of Supplement #2 Account #: 5-31279	Ambareen Siraj	\$78,814	8/17/2017	7/31/2018	\$78,814
22 Development & Validation of Low-Cost, Highly-Durable, Spinel-Based Contact Materials for SOFC Cathode-Side Contact Application US Department of Energy (DOE), Office of Fossil Energy - Cooperative Agreement Account #: 5-32289	Jiahong Zhu	\$154,861	10/1/2017	9/30/2018	\$154,861
23 Evaluating the Mutual Benefits of Deep Learning and Never-Ending Learning to Support Cancer Surveillance and Precision Oncology Oak Ridge National Laboratory Account #: 5-39372	Doug Talbert	\$29,981	9/1/2017	5/31/2018	\$29,981
24 Detection and Analysis of Malware in Critical Infrastructure Oak Ridge National Laboratory - Contract 4000158354 Account #: 5-39371	Sheikh Ghafoor	\$1,900	10/4/2017	9/30/2018	\$1,900
25 Detection and Analysis of Malware in Critical Infrastructure Oak Ridge National Laboratory - Contract 4000158354 Account #: 5-39371	Sheikh Ghafoor	\$14,592	10/4/2017	9/30/2018	\$14,592
26 Detection and Analysis of Malware in Critical Infrastructure Oak Ridge National Laboratory - Contract 4000158354 - Modification #2 Account #: 5-39371	Sheikh Ghafoor	\$24,738	10/4/2017	9/30/2018	\$24,738
27 Detection and Analysis of Malware in Critical Infrastructure Oak Ridge National Laboratory - Contract 4000158 354, Modification #3 Account #: 5-39371	Sheikh Ghafoor	\$43,796	10/4/2017	9/30/2018	\$43,796

Project/Source/Account Number	Principal Investigators	Amount	Beginning	Ending	Estimated - 12 months
28 TTU Senior Design Project - Tether Dynamic Modeling for the Electric Sail Tether Deployment System (Single Source) Marshall Space Flight Center Account #: 5-32435	Stephen Canfield Dale Wilson	\$2,000	9/20/2017	5/10/2018	\$2,000
29 GenCyber Camp at Tennessee Technological University - Summer 2018 National Security Agency and National Science Foundation Account #: 5-32319	Ambareen Siraj	\$123,245	4/1/2018	3/31/2019	\$123,245
30 Advancement of Cryogenic Electronics MIT Lincoln Laboratory - Modification 9, Contact 7000293007 Account #: 5-39376	Wayne Johnson Christopher Wilson	\$200,000	1/1/2018	12/31/2018	\$200,000
31 Tennessee Tech's Participation in Addressing RESEARCH PROBLEMS IN NATIONAL INFORMATION SECURITY through the INSuRE Project Purdue University (via NSA funds) - Contract H98230-17-1-0314 Account #: 5-35451	Ambareen Siraj	\$12,000	8/28/2017	8/27/2018	\$12,000
32 Electro-codeposition of MCrAlY Coatings for Advanced Gas Turbine Applications AESF-Foundation - Year 1 of 3 Account #: 5-32438	Ying Zhang	\$25,000	1/1/2018	12/31/2018	\$25,000
33 Korea/Tennessee Tech Agreement Korea Institute of Industrial Technology Account #: 5-35229	Duckbong Kim	\$5,600	1/2/2018	12/31/2018	\$5,600
34 Summer Undergraduate Research Fellowship (SURF) Program - Gaithersburg National Institute of Standards Account #: 5-32815	Duckbong Kim	\$17,925	5/1/2018	9/30/2018	\$17,925

Grants and Awards Activated in FY 2017-2018 \$2,981,089

Schedule 7

CENTERS OF EXCELLENCE ACTUAL, PROPOSED, AND REQUESTED BUDGET

Institution	Tennessee Technological University						Center	Center for Manufacturing Research		
	FY 2017-18 Actual			FY 2018-19 Proposed			FY 2019-20 Requested			
	Matching	Appropri.	Total	Matching	Appropri.	Total	Matching	Appropri.	Total	
Expenditures										
Salaries										
Faculty	318,120	383,029	701,149	350,000	524,734	874,734	420,000	400,000	820,000	
Other Professional	126,129	344,096	470,225	75,000	393,929	468,929	50,000	350,000	400,000	
Clerical/ Supporting	0	57,893	57,893	0	58,057	58,057	0	50,000	50,000	
Assistantships	249,525	86,252	335,777	250,000	249,188	499,188	280,000	250,000	530,000	
Hourly Students	79,788	39,253	119,041	50,000	66,457	116,457	50,000	60,000	110,000	
Total Salaries	773,562	910,523	1,684,085	725,000	1,292,365	2,017,365	800,000	1,110,000	1,910,000	
Fringe Benefits	299,796	353,294	653,090	275,000	414,359	689,359	225,000	350,000	575,000	
Total Personnel	1,073,358	1,263,817	2,337,175	1,000,000	1,706,724	2,706,724	1,025,000	1,460,000	2,485,000	
Non-Personnel	NOTE: Appropriations Expenditures in Fringe Benefits include \$62,347 for Graduate Student Fees for FY 2017-18.									
Travel	106,923	9,172	116,095	100,000	32,699	132,699	100,000	20,000	120,000	
Software	0	1,080	1,080	0	0	0	0	0	0	
Books & Journals	0	0	0	0	0	0	0	0	0	
Other Supplies	700,588	47,726	748,314	602,343	37,000	639,343	575,000	40,000	615,000	
Equipment	0	47,816	47,816	125,000	19,662	144,662	200,000	100,000	300,000	
Maintenance	0	1,429	1,429	0	0	0	0	0	0	
Scholarships	0	0	0	0	0	0	0	0	0	
Consultants/Subcontracts	91,975	0	91,975	100,000	0	100,000	100,000	0	100,000	
Renovation	0	0	0	0	0	0	0	0	0	
Seminars/Workshops/Conf	413,414	0	413,414	450,000	0	450,000	750,000	0	750,000	
Total Non-Personnel	1,312,900	107,223	1,420,123	1,377,343	89,361	1,466,704	1,725,000	160,000	1,885,000	
GRAND TOTAL	2,386,258	1,371,040	3,757,298	2,377,343	1,796,085	4,173,428	2,750,000	1,620,000	4,370,000	
Revenue	NOTE: Actual Matching Funds do not include Indirect Costs of \$541,251 for FY 2017-2018.									
New State Appropriation	0	1,505,500	1,505,500	0	1,541,400	1,541,400	0	1,620,000	1,620,000	
Carryover State Appropriation	0	120,225	120,225	0	254,685	254,685	0	0	0	
New Matching Funds	2,453,488	0	2,453,488	2,250,000	0	2,250,000	2,750,000	0	2,750,000	
Carryover from Previous Matching Funds	60,113	0	60,113	127,343	0	127,343	0	0	0	
Total Revenue	2,513,601	1,625,725	4,139,326	2,377,343	1,796,085	4,173,428	2,750,000	1,620,000	4,370,000	

NOTE: Carryover appropriation funds of \$254,685 are designated for new faculty recruitment commitments.

FY 2019 – 2020 Budget Request and Justification

The CMR is requesting a **5.0%** increase in the FY 2019-20 State appropriations to account for increasing salaries, benefits, student support, tuition and fees, supplies, and travel costs as well as annual inflationary increases in these budget areas.

There was an increase in the FY18-19 appropriation that was sufficient to cover salary increases of an average of 2.5% for Center faculty and staff along with associated benefits. The increase should also be sufficient to fund operating expenses as planned for this current fiscal year.

Even though the CMR has been successful in securing substantially increased external funding over the past few years, additional State appropriations are being requested to support the research/operational plans listed below.

- While we anticipate continued growth in FY19, there are functions within the Center in support of the research infrastructure and the State manufacturing industry that cannot be paid for with external grants and cost recovery. It is critical that the CMR plan to allocate partial funding annually to replace capital equipment and maintain state-of-the-art research capabilities.
- The requested budget increase will allow the CMR to continue in an effort to fund graduate student stipends at a level consistent with the College of Engineering and to remain competitive with other universities in Tennessee. Attracting and retaining quality graduate students are key to CMR's ability to conduct high-impact research in advanced manufacturing and provide service and support to manufacturing industries.
- The increased core funding will also enable the CMR to promote new research initiatives and incentivize more faculty to contribute to the research and industry engagement in advanced manufacturing area.

SUPPORTING MATERIALS

CMR Supported Graduate Students Degrees Awarded In 2017-2018 Fiscal Year

Masters

Burns, Ryan

“Energy Efficiency Analysis on Tennessee Tech Chiller Plant and HVAC System”
Spring 2018
Advisor: Dr. Glenn Cunningham
Mechanical Engineering

Dugas, Jonathan

“A Study of Electromigration from Superconducting to Normal Conducting Metals”
December 2017
Advisor: Dr. Satish Mahajan
Electrical and Computer Engineering

Ehite, Ekramul Haque

“Experimental Investigation of Electromechanical Impedance-Based Structural Health Monitoring in Highly Dynamic Environments”
Spring 2018
Advisor: Dr. Steve R. Anton
Mechanical Engineering

Howard, Jay

“Cooling Tower Optimization and Analysis Tool”
Spring 2018
Advisor: Dr. Glenn Cunningham
Mechanical Engineering

Imeri, Astrit

“Investigation of the Mechanical Properties for Fiber Reinforced Additively Manufactured Components”
December 2017
Advisors: Dr. Ismail Fidan/Dr. Stephen Canfield
Mechanical Engineering

Jeon, Seongkyul

“Edge Diffraction-Utilized Sensing Method for Cutting Tool Wear Monitoring”
Summer 2017
Advisor: Dr. Mohan Rao
Mechanical Engineering

Kelly, Matthew

“Effect of Ball Milling on Switchgrass, Tall Fescue and Microcrystalline Cellulose: Characterization and Slow Pyrolysis Analysis”
Summer 2017
Advisor: Dr. Joseph Biernacki
Chemical Engineering

Kettle, Ryan

“Electromechanical Impedance Based Microsecond State Detection”

Spring 2018

Advisor: Dr. Steve Anton

Mechanical Engineering

Perry, Garrett

“Design of an External Secondary Support System for Proximal and Middle Phalangeal Fractures Requiring Kirschner Wires”

Summer 2017

Advisor: Dr. Dale Wilson

Mechanical Engineering

Soleymani, Amir Peyman

“Molten NE-AIR Battery: A Novel Cell Design and Electrochemical Approach”

Spring 2018

Advisor: Dr. Stephen Idem

Mechanical Engineering

Spreeman, Matthew

“Role of Compatibilizer in 3D Printed Objects”

Summer 2017

Advisor: Dr. Holly Stretz

Chemical Engineering

Stephanick, Christopher

“Non-Thesis”

December 2017

Advisor: Dr. Christopher Wilson

Mechanical Engineering

Tallapudi, Sashanka

“Synthesis of High Throughput Lithium Carbonate Nanoparticles in a Scalable Microfluidic Reactor”

Fall 2017

Advisor: Dr. Holly Stretz

Chemical Engineering

Zolfaghari Abbasghaleh, Abolfzai

“Study on Multi-Directional Additive Manufacturing

Spring 2018

Advisor: Dr. Yunbo (Will) Zhang

Mechanical Engineering

CMR Supported Graduate Student Degrees Awarded in 2017-2018 Fiscal Year

Ph.D.

Adenson, Michael

“Multi-Scale Modeling of Biomass Pyrolysis—Macro- and Meso-Scale Modeling”
Summer 2017
Advisor: Dr. Joseph Biernacki
Chemical Engineering

Ghasemi Bahraseman, Hamidreza

“Heat and Mass Transfer in Thermal Energy Systems: Evaporation and Energy Storage Applications”
Summer 2017
Advisor: Dr. Ehsan (Ethan) Languri
Mechanical Engineering

Mookiah, Lenin

“Personalized Context Mining of News Streams Using Graph-Based Approaches”
Summer 2017
Advisor: Dr. William Eberle
Computer Science

Sherif, Ahmed

“Towards Privacy-Preserving Services for Autonomous Vehicles (AVS)”
Summer 2017
Advisor: Dr. Mohamed Mahmoud
Electrical and Computer Engineering

Yu, Zetao

“Angle Quantitative Relationship for Automatic Assembly and the Transfer Principle of Geometric Entities”
Spring 2018
Advisor: Dr. Kwun-Ion Ting
Mechanical Engineering

Yu, Zhiyuan

“Gear Curvature Theory”
Summer 2017
Advisor: Dr. Kwun-Ion Ting
Mechanical Engineering

CMR Graduate Students Supported from State Appropriations

Masters

Wesam Abdel. Al Amiri

Advisor: Dr. Mohamed Mahmoud
Electrical & Computer Engineering

Sravanthi Mandalapu

Advisor: Dr. Indranil Bhattacharya
Electrical & Computer Engineering

Farzin Mashali

Advisor: Dr. Ethan Languri
Mechanical Engineering

Sashhanka Tallapudi

Advisor: Dr. Holly Stretz
Chemical Engineering

Ph.D.

Bobby Adams

Advisor: Dr. Cynthia Rice
Chemical Engineering

Hamidreza Bahraseman

Advisor: Dr. Ethan Languri
Mechanical Engineering

Bo Bonning

Advisor: Dr. Holly Stretz
Chemical Engineering

Qing Feng

Advisor: Dr. Robert Qiu
Electrical & Computer Engineering

Benjamin Hargis

Advisor: Dr. Steve Canfield
Mechanical Engineering

Astrit Imeri

Advisor: Dr. Ismail Fidan
Mechanical Engineering

Gholamreza Mirshekari

Advisor: Dr. Cynthia Rice
Mechanical Engineering

Enahoro Oriero

Advisor: Dr. Syed Rafay Hasan
Electrical & Computer Engineering

Jason Witman

Advisor: Dr. Ying Zhang
Mechanical Engineering

Omid Zargar

Advisor: Dr. ChaBum Lee
Mechanical Engineering

Ali Zolghadr

Advisor: Dr. Joe Biernacki
Chemical Engineering

CMR Graduate Students Supported from External Funds

Masters

Wesam Abdel. Al Amiri

Advisor: Dr. Mohamed Mahmoud
Computer Engineering

William Alston

Advisor: Dr. Glenn Cunningham
Mechanical Engineering

Ryan Leaster Burns

Advisor: Dr. Glenn Cunningham
Mechanical Engineering

Jonathan Chappell

Advisor: Dr. Chris Wilson
Mechanical Engineering

Jonathan Dugas

Advisor: Dr. Satish Mahajan
Electrical & Computer Engineering

Ekramul EHITE

Advisor: Dr. Steve Anton
Mechanical Engineering

Tingke Fang

Advisor: Dr. Jiahong Zhu
Mechanical Engineering

Daniel Gothard

Advisor: Dr. Chris Wilson
Mechanical Engineering

Daniel Hott

Advisor: Dr. Chris Wilson
Mechanical Engineering

Jay Howard

Advisor: Dr. Glenn Cunningham
Mechanical Engineering

Astrit Imeri

Advisor: Dr. Ismail Fidan
Mechanical Engineering

Ph.D.

Abolfazi Z. Abbasghaleh

Advisor: Dr. Steve Canfield
Electrical & Mechanical Engineering

Mazen Alwadi

Advisor: Dr. Mohamed Mahmoud
Electrical & Computer Engineering

David Chesson

Advisor: Dr. Jiahong Zhu
Mechanical Engineering

Ekramul EHITE

Advisor: Dr. Steve Anton
Mechanical Engineering

Qing Feng

Advisor: Dr. Robert Qiu
Electrical & Computer Engineering

Md Mahmudul Hasan

Advisor: Dr. ChaBum Lee
Mechanical Engineering

Lily Li

Advisor: Dr. Adam Anderson
Electrical & Computer Engineering

Qinghua Lin

Advisor: Dr. Pinggen Chen
Mechanical Engineering

Mohsen Mohammadabadi

Advisor: Dr. Steve Anton
Mechanical Engineering

Mohammad Mohammadzadeh-Keleshteri

Advisor: Dr. Steve Anton
Mechanical Engineering

Ahmed Sherif

Advisor: Dr. Mohamed Mahmoud
Electrical & Computer Engineering

Joshua Lambert

Advisor: Dr. Wayne Johnson
Electrical & Computer Engineering

Robert Ponder

Advisor: Dr. Steve Anton
Mechanical Engineering

Nicholas G. Russell

Advisor: Dr. Chris Wilson
Mechanical Engineering

Matthew Spreeman

Advisor: Dr. Holly Stretz
Chemical Engineering

Christopher Stephanick

Advisor: Dr. Chris Wilson
Mechanical Engineering

Ali Tanvir

Advisor: Dr. ChaBum Lee
Mechanical Engineering

Rina Singh

Advisor: Dr. Doug Talbert
Computer Science

Yutian Yu

Advisor: Dr. Jiahong Zhu
Mechanical Engineering

Omid Zargar

Advisor: Dr. ChaBum Lee
Mechanical Engineering

External Funding – Proposals Submitted

Status	Title	P.I.	Department	Total Funds
1 100MC-15 5-38585	CMR Testing and Design - 2017-2018 Various Industries	Vahid Motevalli	CMR	\$70,010
2 189MC-17 8/14/2017 20(17-18) 5-33507	UT-CIS Contract (2017-2018) The University of Tennessee Center for Industrial Services	Meenakshi Sundaram	ME	\$20,000
3 189-SD4 8/8/2017 31(17-18) 5-33508	UT-CIS Contract (2017-2018) CAPSTONE The University of Tennessee Center for Industrial Services	Meenakshi Sundaram	ME	\$15,000
4 723MC R 3/7/2018 133(17-18)	Southeast Combined Heat and Power Technical Assistance Partnership (CHP TAP) North Carolina State University (Revised @ request of DOE)	Ethan Languri Glenn Cunningham	ME ME	\$197,933
5 729MC 6/30/2017 11(17-18)	High Performance Laboratory-Scale Gas Atomizer for Materials and Coatings Research The Department of Defense (DoD)	Ying Zhang	ME	\$318,753
6 730MC	CAREER: Sensor Integration in Additive Manufacturing for Part Validation and Structural Health Monitoring National Science Foundation	Steven Anton	ME	\$500,000
7 733MC	CAREER: Unraveling the Structure and Functional Mechanism of Human Beta Defensin Type 3 National Science Foundation	Liquan Zhang	ChemE	\$727,486
8 734MC 8/1/2017 29(17-18)	Emergence of Modern Blacksmith: Decision Support Framework for Wire+Arc Additive Manufacturing NIST	Duckbong Kim	MET	\$545,166
9 735MC 7/13/2017 13(17-18)	Development & Validation of Low-Cost, Highly-Durable, Spinel-Based Contact Materials for SOFC Cathode-Side Contact Application US Department of Energy (DOE), Office of Fossil Energy	Jiahong Zhu	ME	\$300,000
10 736MC 7/31/2017 38(17-18)	Development of Low-Cost Modified MCrAlY Bond with Improved High Temperature Performance for Air-Breathing Gas Turbine Applications US Department of Energy (DOE), National Energy Technology Laboratory	Ying Zhang	ME	\$599,821

	Status	Title	P.I.	Department	Total Funds
11	737MC 12/20/2017 45(17-18)	High Throughput Manufacturing of Nanoparticles for Biomedicine - Phase II (STTR) Chemtor (NIH funds)	Holly Stretz	ChemE	\$293,000
12	738MC 8/23/2017 41(17-18)	REU Site: Manufacturing and Techno-Entrepreneurship, Integrating Entrepreneurship into the Undergraduate Summer Research Experience National Science Foundation	Vahid Motevalli Holly Stretz	COE ChemE	\$383,743
13	739MC 8/23/2017 48(17-18)	In-Situ Cutting Temperature Monitoring at Tool-Chip Interface Using Diamond Waveguide National Science Foundation	ChaBum Lee	ME	\$299,999
14	740MC 9/1/2017 44(17-18) 5-39372	Evaluating the Mutual Benefits of Deep Learning and Never-Ending Learning to Support Cancer Surveillance and Precision Oncology Oak Ridge National Laboratory	Doug Talbert	CompS	\$29,981
15	742MC 9/8/2017 49(17-18)	Improved Precision Spindle Metrology Based on Curved-Edge Diffraction Sensors National Science Foundation	ChaBum Lee	ME	\$287,123
16	743MC 9/5/2017 46(17-18)	Strategies: Collaborative Research: Smart Manufacturing Connecting Cyber Physical Systems to Enterprise for STEM Education National Science Foundation	Ismail Fidan	MET	\$120,000
17	744MC 7/21/2017 52(17-18) 5-39371	Detection and Analysis of Malware in Critical Infrastructure Oak Ridge National Laboratory	Sheikh Ghafoor	CompS	\$98,952
18	744MC R1 5-39371	Detection and Analysis of Malware in Critical Infrastructure Oak Ridge National Laboratory - Revision #1	Sheikh Ghafoor	CompS	\$15,763
19	745MC 10/5/2017 65(17-18)	SMART2 Smart Manufacturing for America's Revolutionizing Technological Transformation Motlow (via NSF Funds)	Ismail Fidan Yunbo Zhang	MET ME	\$209,333
20	746MC 10/3/2017 64(17-18)	ADEPT: The National Center for Additive Production Technologies University of Louisville (via NSF funds)	Ismail Fidan	MET	\$351,632
21	747MC 9/27/2017 59(17-18)	TTU Senior Design Project - Tether Dynamic Modeling for the Electric Sail Tether Deployment System (Single Source) Marshall Space Flight Center	Stephen Canfield Dale Wilson	ME ME	\$2,000

	Status	Title	P.I.	Department	Total Funds
22	749MC 10/6/2017	I-Corps: Advancing High-Quality, Mass-Produced Dinosaur Skeleton Replicas with Low-Cost Additive Manufacturing Technology National Science Foundation	Ismail Fidan	MET	\$50,000
23	751MC 10/25/2017 83(17-18)	A High Precision Oral Capacitive Sensor for Real Time Measurement of Multimode Orthodontic Forces University of Maryland Baltimore (via NIH funds)	ChaBum Lee	ME	\$595,228
24	752MC 11/7/2017 91(17-18)	III:Small:Collaborative Research: Multi-Stream Graph Mining of Temporal Patterns and Anomalies National Science Foundation	William Eberle	CompS	\$232,053
25	753CR 10/27/2017 84(17-18)	GenCyber Camp at Tennessee Technological University - Summer 2018 National Security Agency and National Science Foundation	Ambareen Siraj	CompS	\$123,245
26	754MC 2/5/2018 135(17-18)	MRI: Development of an Instrument for Smart Autonomous Construction of Concrete Structures (SmACCS) National Science Foundation	Joseph Biernacki Henderson/Anton Fidan/Canfield	ChemE Multi Multi	\$1,816,931
27	756MC 11/10/2017 90(17-18) 5-39376	Advancement of Cryogenic Electronics - Years 4, 5, & 6 MIT Lincoln Laboratory	Wayne Johnson Satish Mahajan	ECE ECE	\$1,500,000
28	757MC 12/12/2017 108(17-18)	Low Cost Corrosion and Oxidation Resistance Coatings for Improved System Reliability Faraday Technology, Inc.	Ying Zhang	ME	\$250,000
29	758MC 12/5/2017 102(17-18)	Development of Bimetallic Structures for Liquid-Salt Cooled High Temperature Nuclear Reactor Systems Surficon Technologies, LLC	Ying Zhang	ME	\$34,000
30	759MC 12/6/2017 103(17-18)	Development of Electrically-Conductive Diffusion Barrier Coatings for Protecting Porous Metal Supports Used in Metal-Supported SOFCs University of Louisiana at Lafayette (via DOE funds)	Jiahong Zhu	ME	\$300,000
31	760MC 2/10/2018 137(17-18)	MRI: Acquisition of X-Ray CT Scanner for Functional Materials and Structures Research National Science Foundation	ChaBum Lee	ME Multi	\$276,400
32	761CEROC 11/17/2017 100(17-18) 5-35451	Tennessee Tech's Participation in Addressing RESEARCH PROBLEMS IN NATIONAL INFORMATION SECURITY through the INSuRE Project Purdue University (via NSA funds) - Contract H98230-17-1-0314	Ambareen Siraj	CompS	\$12,000

	Status	Title	P.I.	Department	Total Funds
33	763MC 1/5/2018 114(17-18)	Characterization of Multi-Material Interfaces in Wire+Arc Additive Manufacturing Oak Ridge Associated Universities (ORAU)	Duckbong Kim	MET	\$5,000
34	764MC 1/5/2018 115(17-18)	Developing a Lean-Burn Gasoline Engine with Non-Uniform Cylinder-to-Cylinder Combustion Capabilities Oak Ridge Associated Universities (ORAU)	Pingen Chen	ME	\$5,000
35	765MC	Thermal Management Strategy for Nanopositioning Systems in Extreme Temperature Condition National Science Foundation	ChaBum Lee	ME	\$291,909
36	766MC	Improved Precision Spindle Metrology Based on Curved-Edge Diffraction Sensors National Science Foundation	ChaBum Lee	ME	\$279,555
37	767MC 127(17-18)	In-situ Stress Corrosion Crack Repair and Mitigation for Nuclear Waste Canisters using Cold Spray Process and Mobile Robotics South Dakota School of Mines and Technology (via DOE Nuclear Energy Program)	Stephen Canfield	ME	\$206,497
38	768MC 1/18/2018 120(17-18)	Electro-codeposition of MCrAlY Coatings for Advanced Gas Turbine Applications AESF-Foundation	Ying Zhang	ME	\$75,000
39	769MC 1/31/2018 129(17-18)	Kinematics-based Solution for a Design Autonomous Methodology Involving Products Assembly with Sophisticated Features National Science Foundation	Kwun-lon Ting Yunbo Zhang	ME ME	\$223,065
40	772MC	Incorporating Smart Manufacturing Standards Education into Industrial Automation and Robotics Curricula Development National Institute of Standards and Technologies	Duckbong Kim Ahmed Elsayy	MET MET	\$55,422
41	773MC 3/29/2018 160(17-18)	"Power into Motion Phase IV" Proposed Automotive Powertrain Program at Tennessee Tech Denso North America Foundation	Pingen Chen	ME	\$50,000
42	775MC 4/27/2018 167(17-18)	Development of Anode-Side Interconnect Coating with Unique Features for Innovative Anode-Interconnect Contacting U.S. Department of Energy	Jiahong Zhu	ME	\$500,000
43	776MC 6/29/2018 177(17-18) 5-35229	Korea/Tennessee Tech Agreement Korea Institute of Industrial Technology	Duckbong Kim	MET	\$5,600

Status	Title	P.I.	Department	Total Funds
44 777MC 6/4/2018 176(17-18)	EAGER: Real-Time: Collaborative Proposal: Deep Learning and Testbed for a Large Scale Millimeter Wave System National Science Foundation	Robert Qiu	CMR	\$195,548
45 CEROC1 3/1/2018 151(17-18)	DoD Information Assurance Scholarship Program (IASP) - Tennessee Tech Department of Defense	Ambareen Siraj Eric Brown	CompS CEROC	\$197,218
46 RES1 2/9/2018 140(17-18)	Summer Undergraduate Research Fellowship (SURF) -Boulder National Institute of Standards and Technology	Duckbong Kim	MET	\$47,500
47 Res2 2/9/2018 141(17-18)	Summer Undergraduate Research Fellowship (SURF) Program - Gaithersburg National Institute of Standards and Technology	Duckbong Kim	MET	\$76,000

Proposals Submitted in FY 2017-2018 \$12,788,866

Total New Proposals in FY 2017-2018 \$12,788,866