Microelectronics–Photonics (MEPH)

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Microelectronics-Photonics Program Website (http://microEP.uark.edu/)

Degrees Conferred:
M.S., Ph.D. in Microelectronics-Photonics (MEPH)

Program Description: This multidisciplinary program prepares students for careers in the development and manufacturing of micro- to nanoscale materials, processing, and devices in such industries as biosensing, photonics, telecommunications, microelectronics, and MEMs. Typical students in this program will be full-time students residing on campus, but provisions may be made to support remotely located part-time students already engaged in professional careers.

Philosophy of Graduate Education: All entering graduate students from June 1 through May 31 of the following year are formed into a cohort. Cohort members form a natural work group during their first 24 months of graduate school, and the cohort members receive training in how to effectively apply their academic knowledge in professional group environments such as research- or teaching-based academic departments, large governmental research labs, or industrial settings. The cohort training also fosters a supportive graduate community atmosphere that enhances the likelihood of academic success of all the program's graduate students.The techniques used for this training have been developed at the University of Arkansas under the financial sponsorship of the NSF Integrative Graduate Education and Research Training program, and the Department of Education's Fund for Improvement of Post Secondary Education program. Through these methods, our graduate students exit our degree programs with the equivalent of one and a half years of on-the-job training in management techniques useful in a technology-based professional career setting.

M.S. in Microelectronics-Photonics

Prerequisites to Degree Program: Applicants to the program must satisfy the requirements of the Graduate School as described in this catalog and have the approval of the Graduate Studies Committee of the Materials Science and Engineering program.

Candidates have completed an ABET-accredited or equivalent Bachelor of Science degree in engineering (Washington Accord) and candidates' academic backgrounds will be evaluated by the Graduate Studies Committee for suitability to the graduate program. To be admitted to graduate study in Materials Engineering without deficiency, candidates are required to have completed a math course sequence through differential equations and an introduction to quantum mechanics through courses such as PHYS 3603 Introduction to Modern Physics, PHYS 3613 Modern Physics, or CHEM 3504 Physical Chemistry I. Other undergraduate deficiencies may be identified during the evaluation process, and degree completion will be contingent on successful completion of these identified deficiencies.

Prospective students from foreign countries in which English is not the native language must submit nationally recognized standardized testing results on written English proficiency for consideration by the Graduate School during the admission process. Students may be given conditional admittance pending demonstration of English language skills in appropriate courses at the University of Arkansas. Students wishing to apply for graduate assistantships that require direct contact with students in a teaching or tutorial role must meet the Graduate School's English Language proficiency test requirements for such GA positions.

Requirements for the Master of Science in Materials Engineering Degree: Students choosing this degree program will be assigned an initial adviser upon acceptance to the program. Students will work with the MSEN Program Director to define their M.S. path to best support their career goals after graduation, with three curricula paths available to Materials Engineering students:

- Academic path: Students who plan to complete an academic campus-based research thesis will take this path, although the research topic may include funding and collaboration with outside technical organizations. Students who complete all requirements for M.S. graduation, including an independent research project and thesis acceptable to their thesis committee, will be eligible without Graduate Studies Committee review for admission to the Ph.D. program in Materials Science and Engineering.
- Professional path: Students who plan to enter the technical marketplace after M.S. completion will find this path most beneficial as it requires independent graduate-level research in collaboration with an external technical organization. The research may be in the form of a traditional M.S. six-hour research topic and thesis, or may instead be in the form of two three-hour independent research efforts resulting in written reports with the clarity, style, analysis, and conclusions expected of a journal paper submission. Both the thesis and the written reports will be orally defended before the appropriate student committee. Students in this path will also be required to complete at least one internship of at least six weeks duration to experience a non-academic technical environment. Students completing this path may be considered by the Graduate Studies Committee for admission to the Ph.D. program in Materials Science and Engineering based on the strength of their academic course grades, their independent research depth, and the quality of the written research document.
- Non-thesis path: Students who are funded by personal resources or by graduate assistantships not associated with research or educational grants may complete an M.S. degree with additional course work in place of independent research. While there may be specific narrow career options where this is an appropriate path, the Materials Science and Engineering program strongly recommends the Professional or Academic paths as providing a much better overall career preparation for working in a technical position. Students completing this path cannot be accepted into the Ph.D. program in Materials Science and Engineering.

Students will form either a thesis committee or an advisory committee after they have chosen their M.S. path, defined any independent research areas, and have been accepted into a research group if appropriate. A thesis committee will be made up of at least three faculty members, with at least one faculty member each from the Fulbright College of Arts and Sciences and the College of Engineering (the student's research professor will chair the thesis committee). The advisory committee will include at least one member of the Graduate Studies Committee, the supervising faculty member for a research experience, and one additional faculty member. If the student is in the Professional path, then either committee must also include at least one technical professional from the

partner external organization as an adjunct faculty member or an ex officio committee member.

Students in this degree program can choose an Academic path, a Professional path, or a Non-thesis path. The course hours to meet the minimum requirements for each path are as follows:

Subject Area	Academic Path/ Hours	Professional Path/Hours	Non-Thesis Path/Hours
MSEN 5733L Fabrication at the Nanoscale OR ELEG 5243L Microelectronic Fabrication Techniques and Procedures OR ELEG 5293L Integrated Circuits Fabrication Laboratory OR MEEG 5633 Additive Manufacturing	3	3	3
MSEN 5322 Materials Characterization (Core)	2	2	2
MSEN 5313 Fundamentals of Materials Science (Core)	3	3	3
MSEN 5383 Research Commercialization and Product Development (Core)	3	3	3
MSEN 5811 / MSEN 5911 / MSEN 6811 / MSEN 6911 Operations Management Seminar Series (Core)	4	4	4
MSEN 6323 Materials Engineering Design (Core)	3	3	3
Technical Electives from Concentration List	9	9	9
MSEN 600V Research Thesis	6	(Option) 6	0
MSEN 5513 Applied Research in External Technical Organizations	Not Available	(Or Option) 3 + 3	Not Available
MSEN 5523 Applied On-Campus Collaborative Research with External Technical Organizations	Not Available	(Or Option) 3 + 3	Not Available
MSEN 555V Internship in External Technical Organization or GNEG 5811 Alternating Cooperative Education	Optional (hours do not apply to degree requirement)	>/= 1	Optional (hours do not apply to degree requirement)
MSEN 5821 Ethics for Scientists and Engineers	1 (Applied in Ph.D. curriculum)	1	1
Additional Technical Elective	0	0	>/=2
MSEN 5253 Emerging Technologies in Industry	Recommended in PhD studies	Recommended in PhD studies	3
MSEN 5393 Product Development Process	N/A	N/A	3

If a University of Arkansas undergraduate student is pursuing a Bachelor of Science degree in a department that has implemented an accelerated B.S./M.S. program (typically allowing six hours of graduate-level course work to be shared between the two degrees), the student may implement the same acceleration for a B.S. departmental degree/M.S. Materials Engineering degree set. Both the undergraduate department and the MSEN Program Director must approve the shared courses prior to enrollment.

As part of each student's curriculum, nine hours of coursework must be taken through one of the following concentrations. Courses not listed in the concentration list, but clearly pertaining to the concentration area, may be substituted with the approval of the student's research adviser and the MSEN Program Director. Students who have acquired the knowledge contained in any of the required courses through prior education may petition the MSEN Program Director for permission to substitute other classes for these required courses.

Additional core courses to develop operations management skills also have been defined for MSEN students. During year one of their graduate studies at the University of Arkansas, students are required to take

MSEN 5811 1st Year Operations Seminar - Infrastructure Management and MSEN 5911 1st Year Operations Seminar - Personnel

Management in the fall and spring semesters and MSEN 5821 Ethics for Scientists and Engineers in their first summer. During year two, students are required to take MSEN 6811 2nd Year Operations Seminar - Management and Leadership and MSEN 6911 2nd Year Operations Seminar - Advanced Management and Leadership in the fall and spring semesters, respectively. Students who begin their graduate studies at the University of Arkansas during the spring semester will be required to take MSEN 5811 in the fall semester following their completion of MSEN 6911 or to take MSEN 5811 concurrently with MSEN 6811.

Students are required to attend monthly MSEN Research Communication Seminars during the first three semesters of their M.S. degree program, and will enroll in MSEN 5611 Research Communication Seminar of MS Students in their third semester. Students working more than 20 hours per week in a non-local technology-based professional position approved by the MSEN Director will not be required to be enrolled in this class or attend the monthly seminars as a condition for graduation.

Research thesis hours will be chosen from the student's research adviser's section (MSEN 600V) and will require a written thesis successfully defended in a comprehensive oral exam given by the thesis committee.

A research thesis is required for Academic path students, and is optional for Professional path students. Professional path thesis research must include direct collaboration with an external technical organization.

A student in the Professional path may substitute two Applied Research efforts for a thesis under MSEN 5513 (External location) or MSEN 5523 (Internal on-campus location), provided each semester's research is of graduate-level quality and is reported at the end of the semester through a written paper and in an oral presentation to the advisory committee (note that the written paper must match the clarity, style, analysis, and conclusions expected of a journal paper submission). Regardless of where the research is performed, it must include direct collaboration with an external technical organization.

If a student is taking either a special problems independent study course (such as MSEN 588V) or a special topics course (such as MSEN 587V) to meet partial requirements for their M.S. degree, the instructor must supply the MSEN program office with a syllabus of that class to be included in their program records. The syllabus must include at least the course title, semester, instructor name, a list of specific course objectives, a list of student learning outcomes, sources of content knowledge, and method by which the student's mastery of the learning objectives is demonstrated.

Each student is required to enroll in at least one hour of course work each fall and spring semester until the M.S. degree is issued. If all required course work has been completed, the student may enroll in one hour of master's thesis, or in one hour of a special problems course for credit only.

Students should also be aware of Graduate School requirements with regard to master's degrees (http://catalog.uark.edu/graduatecatalog/degreerequirements/#mastersdegreestext).

Ph.D. in Microelectronics-Photonics

Students choosing this degree program will be assigned an initial adviser upon acceptance to the program. Students will work with the Materials Science and Engineering Program Director to define their dissertation committee after they are accepted by a research faculty for a research project. This committee will be made up of at least four faculty members, with at least one faculty member each from the Fulbright College of Arts and Sciences and the College of Engineering. The student's research professor will chair the dissertation committee.

Candidates for the Ph.D. program are expected to have completed a Master of Science degree in either engineering or science, with each candidate's academic background being evaluated by the Graduate Studies Committee of the Materials Science and Engineering program. Doctoral candidates in Materials Science and Engineering are expected to have proficiency in the core curriculum of the Master of Science in Materials Engineering or Master of Science in Materials Science at the University of Arkansas. This core is described in the requirements for the Master of Science in Materials Engineering and the Master of Science in Materials Science, as well as in the handbook of the Materials Science & Engineering program.

Students who have graduated with a Master of Science degree in Materials Engineering or a Master of Science degree in Materials Science will be expected to take the Materials Science and Engineering Ph.D. candidacy exam. The Materials Science and Engineering Ph.D. candidacy exam is a detailed Ph.D. research proposal and it must be accepted by the student's committee before the end of the 30th month after the start date of the student's first semester as a Ph.D. student, or the student will be removed from the Ph.D. program. The student is to complete the candidacy exam process after having completed MSEN 5383 Research Commercialization and Product Development and MSEN 6323 Materials Engineering Design.

A Ph.D. curriculum will be defined to meet each student's research interests as well as ensure the Materials Science and Engineering program's core courses have been taken. The course plan for each student must include a minimum of 27 hours of graduate coursework beyond the Master of Science degree requirements. Specific courses will be chosen by the student and must be approved by the student's major professor and the MSEN Program Director. The coursework list for the Ph.D. degree will be dependent upon the M.S. degree with which the student enters the program:

Subject Area	M.S. in Materials Engineering or Materials Science from UA/Hours	M.S. in Materials Engineering or Materials Science from another institution/ Hours	Other Science or Engineering M.S. degrees/ Hours
MSEN 6313 Advanced Materials Science & Engineering	3	3	3
BENG 5703 Design and Analysis of Experiments for Engineering Research OR INEG 5333 Design of Industrial Experiments OR other Design of Experiments course	3	3	3

MSEN 5821 Ethics for Scientists and Engineers	1 (Applied from MS curriculum)	1	1
MSEN 6323 Materials Engineering Design	If not taken in MS curriculum	3	3
MSEN 5811 / MSEN 5911 / MSEN 6811 / MSEN 6911 Operations Management Seminar Series (Core)	Taken in MS curriculum	4	4
MSEN 5383 Research Commercialization and Product Development	Taken in MS curriculum	3	3
5000- and 6000-level elective courses in science and engineering	17-20	10	5
MSEN 5322 Materials Characterization	Taken in MS curriculum	Recommended elective	2
MSEN 5313 Fundamentals of Materials Science	Taken in MS curriculum	Recommended elective	3
MSEN 5253 Emerging Technologies in Industry	Recommended elective	Recommended elective	Recommended Elective
MSEN 700V Dissertation	21	21	21
Total	48	48	48

If a student is taking either a special problems independent study course, such as MSEN 588V, or a special topics course, such as MSEN 587V, to meet partial requirements for their Ph.D. degree, then the instructor must supply the Materials Science and Engineering program office with a syllabus of that class to be included in their program records. The syllabus must include at least the course title, semester, instructor name, a list of specific course objectives, a list of student learning outcomes, sources of content knowledge, and method by which the student's mastery of the learning objectives is demonstrated.

Students are required to attend monthly Materials Science and Engineering Research Communication Seminars during the first five semesters of their Ph.D. degree program, and will enroll in MSEN 6611 Research Communication Seminar of PhD Students in their fifth semester.

The dissertation format must meet all Graduate School published guidelines and the guidelines as listed in the Materials Science and Engineering Graduate Student Handbook. Students may use bound published papers for their dissertation provided that:

1. It contains a minimum of three peer-reviewed archival journal articles which have been published or accepted for publication;
2. The Ph.D. candidate is first author on all articles used; and,
3. It contains additional text to connect the articles in the context of the overall research effort in accordance with the Graduate School guidelines and must include program required front matter and appendices.

If submission of a third paper is held up due to an intellectual property filing, or IP filing, the third paper prepared for submission for a peer-reviewed archival journal may be included in the dissertation to meet the three paper requirement if a patent disclosure covering the intellectual property has been approved for provisional filing by the University of Arkansas patent committee. The patent disclosure and documentation of approval for provisional filing must be contained within an appendix to the dissertation.

Students should also be aware of Graduate School requirements with regard to doctoral degrees (http://catalog.uark.edu/graduatecatalog/degreerequirements/#phdandedddegreestext).

Graduate Faculty

Balachandran, Kartik, Ph.D., M.S. (Georgia Institute of Technology), B.S. (National University of Singapore), Associate Professor, Department of Biomedical Engineering, 2012, 2018.

Barraza-Lopez, Salvador, Ph.D. (University of Illinois-Urbana-Champaign), B.S. (Instituto Politecnico Nacional de Mexico), Associate Professor, Department of Physics, 2011, 2016.

Bellaiche, Laurent, Ph.D., M.S., B.S. (University of Paris VI, France), Distinguished Professor, Department of Physics, 1999, 2016.

Benamara, Mourad, Ph.D., M.S. (University of Toulouse III, France), Assistant Professor, Nanotechnology, 2007.

Chen, Jingyi, Ph.D. (University of Washington), M.A. (State University College at Buffalo), B.S. (Zhongshan University), Professor, Department of Chemistry and Biochemistry, 2010, 2019.

Chen, Zhong, Ph.D. (North Carolina State University), M.Eng. (National University of Singapore), B.S. (Zhejiang University), Assistant Professor, Department of Electrical Engineering, 2015.

Churchill, Hugh O.H., Ph.D., A.M. (Harvard University), B.A. (Oberlin College), B.M. (Oberlin Conservatory of Music), Associate Professor, Department of Physics, 2015, 2021.

Coridan, Robert, Ph.D., M.S. (University of Illinois-Urbana-Champaign), B.S. (The Ohio State University), Associate Professor, Department of Chemistry and Biochemistry, 2015, 2021.

Di, Jia, Ph.D. (University of Central Florida), M.S., B.S. (Tsinghua University), Professor, Department of Computer Science and Computer Engineering, 21st Century Research Leadership Chair, 2004, 2014.

Dix, Jeffrey, Ph.D., M.S., B.S.E.E., (University of Tennessee, Knoxville), Assistant Professor, Department of Electrical Engineering, 2018.

Dong, Bin, Ph.D. (Iowa State University), B.S. (Xiamen University), Assistant Professor, Department of Chemistry and Biochemistry, 2022.

Edwards, Martin, Ph.D., M.Sc., M.Math. (University of Warwick), Assistant Professor, Department of Chemistry and Biochemistry, 2020.

El-Shenawee, Magda O., Ph.D. (University of Nebraska-Lincoln), M.S., B.S. (Assiut University, Egypt), Professor, Department of Electrical Engineering, 2001, 2010.

Fritsch, Ingrid, Ph.D. (University of Illinois-Urbana-Champaign), B.S. (University of Utah), Professor, Department of Chemistry and Biochemistry, 1992, 2005.

Fu, Huaxiang, Ph.D., M.S. (Fudan University), B.S. (University of Science and Technology of China), Professor, Department of Physics, 2002, 2017.

Gea-Banacloche, Julio R., Ph.D. (University of New Mexico), Licenciado en Ciencias Fisicas (Universidad Autonoma de Madrid), Professor, Department of Physics, 1989, 2000.

Heyes, Colin David, Ph.D. (Georgia Institute of Technology), B.S. (Loughborogh University), Professor, Department of Chemistry and Biochemistry, 2008, 2021.

Hu, Jin, Ph.D. (Tulane University), B.S. (University of Science and Technology of China), Assistant Professor, Department of Physics, 2017.

Huitink, David, Ph.D., M.S.M.E., B.S.M.E. (Texas A&M University), Associate Professor, Department of Mechanical Engineering, 2016, 2022.

Jensen, Morten O., Ph.D. (University of Aarhus, Denmark), M.Sc. (Georgia Institute of Technology), Associate Professor, Department of Biomedical Engineering, 2014.

Kim, Jin-Woo, Ph.D. (Texas A&M University), M.S. (University of Wisconsin-La Crosse), B.S. (University of Iowa), Professor, Department of Biological and Agricultural Engineering, 2001, 2011.

Kohanek, Julia, Ph.D. and M.S. (University of Illinois Urbana-Champaign), B.S. (University of Michigan), Instructor, Department of Chemistry and Biochemistry, 2019, 2022.

Kumar, Pradeep, Ph.D. (Boston University), M.Sc. (Indian Institute of Technology, Mumbai, India), Associate Professor, Department of Physics, 2013, 2019.

Leftwich, Matthew, Ph.D., M.S. and B.S. (University of Arkansas), M.B.A. (Webster University), Research Professor, Department of Physics, 2021.

Li, Jiali, Ph.D., M.S. (The City College of the City University of New York), M.S. (University of Science and Technology of China), B.S. (Hei Long Jiang University), Professor, Department of Physics, 2002, 2016.

Li, Yanbin, Ph.D. (Pennsylvania State University), M.S. (University of Nebraska-Lincoln), B.S. (Shenyang Agricultural University), Distinguished Professor, Department of Biological and Agricultural Engineering, Tyson Endowed Chair in Biosensing Engineering, 1989, 2003.

Manasreh, Bothina H., Ph.D., M.Sc. (University of Jordan), Research Assistant Professor, Department of Physics, 2017.

Manasreh, Omar, Ph.D. (University of Arkansas), M.S. (University of Puerto Rico-Rio Piedras), B.S. (University of Jordan), Professor, Department of Electrical Engineering, 2003.

Mantooth, Alan, Ph.D. (Georgia Institute of Technology), M.S., B.S. (University of Arkansas), Distinguished Professor, Department of Electrical Engineering, Twenty-First Century Chair in Mixed-Signal IC Design and CAD, 1998, 2011.

McCann, Roy A., Ph.D. (University of Dayton), M.S.E.E., B.S.E.E. (University of Illinois), Professor, Department of Electrical Engineering, 2003, 2009.

Meng, Xiangbo, Ph.D. (University of Western Ontario), M.S.E.E. (China University of Petroleum), B.S.C.E. (Northwestern University), Associate Professor, Department of Mechanical Engineering, 2016, 2022.

Millett, Paul, Ph.D., M.S. (University of Arkansas), B.E. (Vanderbilt University), Associate Professor, Department of Mechanical Engineering, Twenty-First Century Professor, 2013, 2019.

Moradi, Mahmoud, Ph.D. (North Carolina State University), M.S., B.S. (Sharif University of Technology), Associate Professor, Department of Chemistry and Biochemistry, 2015, 2021.

Nair, Arun, Ph.D. (Virginia Polytechnic State University), M.S. (Colorado State University), B.T. (Mahatma Gandhi University), Associate Professor, Department of Mechanical Engineering, 2013, 2019.

Nakamura, Hiroyuki, Ph.D., M.S., B.S. (University of Tokyo), Assistant Professor, Department of Physics, 2019.

Naseem, Hameed A., Ph.D., M.S. (Virginia Polytechnic State University), M.Sc. (Panjab University), University Professor, Department of Electrical Engineering, 1985.

Oliver, William, Ph.D., M.S. (University of Colorado-Boulder), B.S. (University of Arizona), Associate Professor, Department of Physics, 1992, 1998.

Pohl, Edward A., Ph.D., M.S.R.E. (University of Arizona), M.S.S.E. (Air Force Institute of Technology), M.S.E.M. (University of Dayton), B.S.E.E. (Boston University), Professor, Department of Industrial Engineering, Twenty-First Century Professorship in Engineering, 2004, 2013.

Porter, Errol, M.S.E.E., B.S.E.E. (University of Arkansas), Research Associate, 1997, 1999.

Salamo, Gregory J., Ph.D. (City University of New York), M.S. (Indiana University-Purdue University-Indianapolis), B.S. (City University of New York, Brooklyn College), Distinguished Professor, Department of Physics, 1975, 2005.

Selvam, R. Panneer, Ph.D. (Texas Tech University), M.S.C.E. (South Dakota School of Mines and Technology), M.E., B.E. (University of Madras, India), University Professor, Department of Civil Engineering, 1986, 2010.

Singh, Surendra P., Ph.D., M.A. (University of Rochester), M.Sc., B.Sc. (Banaras Hindu University, India), University Professor, Department of Physics, 1982, 2016.

Stenken, Julie A., Ph.D. (University of Kansas), B.S. (University of Akron), Professor, Department of Chemistry and Biochemistry, 21st Century Chair of Proteomics, 2007.

Tian, Ryan, Ph.D. (University of Connecticut), B.S. (Fudan University, Shanghai), Associate Professor, Department of Chemistry and Biochemistry, 2004, 2010.

Tung, Steve, Ph.D., M.S.M.E. (University of Houston), B.S.M.E. (National Taiwan University), Professor, Department of Mechanical Engineering, 2000, 2013.

Walters, Keisha, Ph.D., M.S., B.S. (Clemson University), Professor, Ralph E. Martin Department of Chemical Engineering, Kevin W. and Marie L. Brown Department Head Chair in Chemical Engineering, Ralph E. Martin Leadership Chair in Chemical Engineering, 2021.

Wang, Feng, Ph.D. (University of Pittsburgh), Ph.D. (Kutztown University of Pennsylvania), B.S. (Peking University), Associate Professor, Department of Chemistry and Biochemistry, Charles E. and Clydene Scharlau Endowed Professor, 2012.

Wang, Yong, Ph.D., M.S. (University of California, Los Angeles), B.S. (University of Science and Technology of China), Assistant Professor, Department of Physics, 2016.

Ware, Morgan, Ph.D. (North Carolina State University), B.S. (Florida State University), Assistant Professor, Department of Electrical Engineering, 2005.

Wejinya, Uchechukwu C., Ph.D., M.S., B.S. (Michigan State University), Associate Professor, Department of Mechanical Engineering, Twenty-First Century Professor, 2008, 2014.

Wickramasinghe, Ranil, Ph.D. (University of Minnesota-Twin Cities), M.S., B.S. (University of Melbourne, Australia), Distinguished Professor, Ralph E. Martin Department of Chemical Engineering, Ross E. Martin Chair in Emerging Technologies, 2011, 2021.

Yu, Fisher, Ph.D. (Arizona State University), M.S., B.S. (Peking University), Associate Professor, Department of Electrical Engineering, 2008, 2014.

Zhou, Wenchao, Ph.D. (Georgia Institute of Technology), M.S.M.E. (Xi'an Jiaotong University, Xi'an, China), B.S.M.E. (Huazhong University of Science and Technology, Wuhan, China), Associate Professor, Department of Mechanical Engineering, 2014, 2020.

Zou, Min, Ph.D., M.S.M.E. (Georgia Institute of Technology), M.S.A.E., B.S.A.E. (Northwestern Polytechnical University), Professor, Department of Mechanical Engineering, Twenty-First Century Chair in Materials, Manufacturing and Integrated Systems, 2003, 2013.