



M **ECHANICAL ENGINEERING** **VIBRATIONS**



Inside This Issue:	
Chairman's Message	1
New Faculty Member	2
Sorem H.O.P.E. Award	3
Entrepreneur's Corner	3
Alumni Focus	4
KUME Impact	6
2016 Graduates	7
Donor Recognition	8

Vibrations is the annual newsletter of the University of Kansas Department of Mechanical Engineering, sent to over 3000 alumni and over 500 friends of the Department.

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Message from the Chairman



I hope you enjoy this issue of *Vibrations*, which highlights activities within KUME and of some of our many outstanding alumni. This also marks the last issue that will be published during my term as chairman of the department. It has been an honor and privilege to serve as the chair, and I am looking forward to returning to life as a regular faculty member. Dr. Ken Fischer will be chairman on an interim basis during the 2017-2018 academic year.

When I interviewed with the KU faculty in the Spring of 2012, I proposed two primary objectives for the department during the upcoming five years. The first was to expand our relations with industry, and the second was to increase the scholarly productivity of the faculty and students. Achieving these goals would make KUME a more attractive destination for both prospective students and potential faculty members. I was fortunate to be given the opportunity to return to KU in the Fall of 2012, allowing me to contribute to the department from which I received my BSME degree many years ago.

A series of *Biennial Reports*, available online at <https://me.engr.ku.edu/>, details the progress made over the past five years. As noted in the most recent *Report*, the number of journal articles, books, and book chapters published by KUME students and faculty members on an annual basis doubled from 2011 - 2012 to 2015 - 2016, while the number of U.S. patents received annually by KUME faculty members increased six-fold. The number of two-semester capstone projects, in which our undergraduate students work directly with engineers from industry, grew from about 4 per year to 22 per year in just five years. Editorial positions on major journals held by our faculty increased by 150%, and the annual citations of our published research nearly doubled. Other highlights include larger enrollments, our Jayhawk Motorsports team winning national championships in 2013 and 2015, a tremendous increase in the size and quality of our teaching and research facilities, hiring a full-time faculty member who is financially supported entirely by industry, and establishing two new endowed professorships in mechanical engineering.

I would like to take this opportunity to thank the hundreds of KU alumni and individuals from industry (who often have no personal connection whatsoever to KU) for the financial support of KUME that has made many of our achievements possible. Meeting and working with you has been both pleasurable and inspirational, and I hope we will stay in touch.

Regards,

A handwritten signature in black ink that reads "Theodore L. Bergman".

Theodore L. Bergman
Charles E. & Mary Jane Spahr Professor
Chairman, Department of Mechanical Engineering

Michael Ohadi to Join KUME



Michael Ohadi, Professor of Mechanical Engineering at the University of Maryland, will join KU for the Spring semester of 2018. He will hold the *Harold L. Kipp & John E. Kipp Professorship of Mechanical Engineering*, recently established by Robert and Deborah Kipp.

Dr. Ohadi's research interests range from application of electrohydrodynamics for fluid flow as well as heat and mass transfer enhancement, to the development of novel heat transfer surfaces and heat exchangers using a combination of advanced materials and manufacturing techniques. Applications include those in the aerospace, defense, power and process industries. He also leads efforts in advanced energy auditing of buildings and industrial facilities that reduce energy consumption and cost. Key to addressing these challenges is controlling heat and mass transfer processes to both increase the efficiency and reduce the size and weight of various devices. Dr. Ohadi's current approach is to develop (i) unique additive manufacturing techniques to realize radical designs for process equipment such as heat exchangers and (ii) new materials that are compatible with additive manufacturing techniques and are able to withstand high temperatures and pressures under operating conditions.

Mike Ohadi received his Ph.D. from the University of Minnesota in 1986 and began his career at the Michigan Technological University. He has been with the University of Maryland (UMD) since 1990. Ohadi is co-founder of the Center for Environmental Energy Engineering at UMD, and currently serves as UMD's Director of the Consortium on Advanced Heat Exchangers/Process Intensification which involves industry partners from the U.S., Europe, and Asia.

In addition to his many university research and teaching activities, Dr. Ohadi was provided with a multi-year professional leave from UMD to serve as the Founding Director of Mechanical Engineering, Provost, and Acting President of The Petroleum Institute, a new university in Abu Dhabi, UAE that developed partnerships with UMD, the Colorado School of Mines, the University of Minnesota, Rice University, The University of Texas at Austin, and others. He currently splits his time between UMD and the U.S. Department of Energy where he serves as a Program Director, providing vision and funding for both university and corporate researchers to enable a new generation of thermal processing and energy generation strategies.

Dr. Ohadi has authored or co-authored approximately 250 articles in peer-reviewed journals and conference proceedings, as well as two books, and 22 book chapters. He holds 8 U.S. patents and has two pending U.S. patent applications along with several provisional patent applications. Among Ohadi's many awards and recognitions are his fellow status in the American Society of Mechanical Engineers (ASME) as well as the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE). He is the 2014 recipient of the UMD System Board of Regents Excellence in Innovation Award, as well as the E.K. Campbell Award of Merit from ASHRAE, the ASHRAE Exceptional Service Award, the ASHRAE Distinguished Service Award, and the Distinguished Service Award from the Society of Petroleum Engineers. He also received a Recognition Award for service to the Institute for Electrical and Electronics Engineers (IEEE) in 2017.

Dr. Ohadi believes that "there are countless exciting challenges and opportunities for developing the next generation of smart, compact, and conforming energy conversion devices that incorporate a combination of innovative design, new materials, and novel manufacturing techniques. KU offers the laboratories and research environment to grow this area of research."

Sorem wins H.O.P.E. Award

Robb Sorem, Associate Professor and Executive Associate Department Chair, was named the University's H.O.P.E. Awardee on November 19, 2016. The award, meant to *honor an outstanding progressive educator*, was established in 1959 and is the singular most important student-voted accolade at KU.

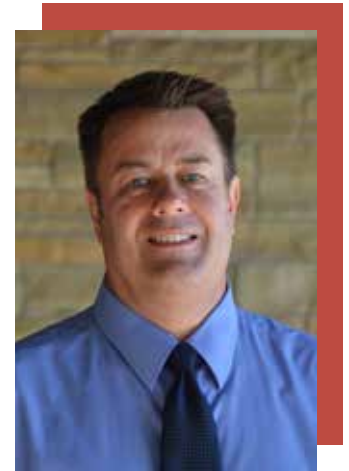
Dr. Sorem received his BSME, MSME and Ph.D. degrees, all from KU. After several years at Schlumberger Oilfield Services in Houston where he co-developed 17 U.S. patents, Robb returned as a faculty member in 1994. Bringing a wealth of practical experience to the classroom, Robb also served as Associate Dean for Undergraduate Studies in the School of Engineering from 2002 to 2012. Notably, Dr. Sorem has served for 23 years as the faculty advisor to KUME's Formula SAE student racing team, Jayhawk Motorsports, winners of multiple recent national competitions. In recognition of his FSAE contributions, he received the Carroll Smith Mentor's Cup in 2009.

"I was surprised to be nominated for the H.O.P.E. Award," admits Robb. "I was even more surprised to learn that I was a finalist, and I was shocked to hear my name called as the 2016 recipient at halftime of the KU-Texas football game." Adds Sorem, "as teachers we all dream of being honored like this, but actually receiving such a recognition is truly humbling."

Dr. Sorem teaches courses in mechanics, finite element analysis, and capstone design. When asked for advice he would pass on to those in the teaching profession, Robb responded, "My role models when I was a student were Chuck Reese and Karan Surana. Not only did they teach me the technical material, but they showed me the importance of having deep knowledge of the subject matter as well as being prepared and organized. And, one size doesn't fit all. New techniques, tools, and methodologies continuously evolve, so it's important for each instructor to find what fits best for them and the subject matter they are teaching. I use tradition-

al techniques in some of my classes that cover fundamental topics, and new experiential learning methods in others."

Department Chairman Ted Bergman notes that "Only five School of Engineering faculty members have received the H.O.P.E. Award in its history, with Dr. Sorem being the third from Mechanical Engineering, joining Ed McBride and Bedru Yimer. KUME has received an inordinate share of H.O.P.E. recognition over the years, and we are proud that Robb and our student voters have continued the tradition."



Entrepreneur's Corner

Leighton LaPierre (BSME, 2006; MSME, 2008) became CEO of Evoke Medical, LLC in November of 2016. He was previously a project engineer and market manager for several spinal implant companies. Evoke Medical is a startup based on KU spinal fusion implant technology. Leighton will represent Evoke as one of 50 up-and-coming global medical technology startups invited to showcase their companies at the MedTech Conference in San Jose this September. Leighton reports that "the focus on biomedical engineering and applied research during my time at KU was invaluable in helping me pursue my dreams of running a business and ultimately bringing life improving technologies to physicians and their patients."

Steve Kibbee: Offshore Oil Innovator and Entrepreneur

Massive in size, offshore oil rigs and production platforms present some of the most daunting and complex design challenges faced by engineers. Until 1947, no company had risked drilling out of sight of land, a barrier that was broken 10 miles offshore in just 14 feet of water. Today, offshore platforms can operate in water depths exceeding 9000 feet, pushing the envelope of engineering know-how and requiring new, fundamental understanding of how structures, materials, and equipment behave in extreme environmental conditions, and when subjected to hundreds of atmospheres of pressure at the sea floor. The price tag of a modern offshore platform can exceed \$1 billion.

Steve Kibbee grew up in Kansas City, Kansas and moved to Lenexa when he was a junior at Turner High School. He commuted between Turner and Lenexa his last year, graduating as valedictorian in 1969. Following the footsteps of his brother Gary (who received his BSME and MSME degrees from KU about ten years earlier) Steve earned his bachelor's degree from KU in mechanical engineering, with highest distinction, in 1973.

Steve's first full time job was with Exxon Production in Houston, but he was soon transferred to Tyler where he was "surrounded by Aggies from Texas A&M." Inspired by Gary and his older sister Sandra, both of whom held doctoral degrees, Steve soon enrolled in the doctoral program in mechanical engineering at A&M, graduating in 1979.

It was during his time in graduate school that Steve interned at Brown & Root and was first exposed to the challenges of offshore oil and gas production. Later, he accepted a position at Getty Oil Research Division, working with a small group of engineers. "We were at the edge of deepwater engineering," recalls Steve. "Explorers were finding the deepwater oil and gas deposits, but we had to invent ways to get the product to the surface safely, and continuously

for 20 years and more." Dr. Kibbee remained in the deepwater business, working on record-breaking projects and partnerships involving oil giants Texaco, Sohio, British Petroleum, and Shell until 1990, when he became the third partner of a 10-person company called Atlantia.

While Steve was recognized for his work on production platforms for huge, deepwater oil and gas fields, Atlantia's business concentrated on inexpensive, low-volume, shallow-water platforms. "I had known the husband and wife partners who founded Atlantia, Joe and Pat Blanford, for about five years. At that time, there were few viable ways to extract oil and gas from small deepwater, discoveries. The three of us realized that we might address the need by combining our expertise," he explained.

Steve envisioned a deepwater platform that would make economic sense for the smaller oil and gas fields that oil companies sometimes discovered as they explored for huge fields. Instead of supporting a large deck on top of a massive bottom founded or floating structure, Steve's Seastar® technology supported a small deck on top of a single buoyant column equipped with pontoons and a tension leg mooring. The deck would support key production and control equipment that would assure flow from satellite



Installation of a Seastar® submersible hull.

subsea wells in smaller fields. The Seastar TLP enabled production of some fields that would have otherwise not been developed.

Of course, bringing Dr. Kibbee's concept to reality would require significant engineering effort and, as a small company, Atlantia's financial resources were limited. By happenstance, Steve became aware of the Small Business Innovation Research (SBIR) Program of the U.S. Department of Energy (DOE), and applied for funding that would allow the concept to be further developed. "Atlantia had never submitted a grant proposal before, and my concept didn't fit with any of DOE's categories of interest," admits Steve. "But I needed something to work on in the evenings when I was on assignment away from home, so I wrote a proposal and submitted it." Steve continued, "To everyone's surprise we were funded, allowing Atlantia to hire some of the 'leading light' engineers in the deepwater industry to continue with the design. Unfortunately, two years later, our DOE funding would expire and we entered the 'valley of death,' not knowing if years of effort would ever pay off."

In the meantime, Atlantia's small-volume, shallow-water business remained steady and, according to Steve, "we would pitch the Seastar concept to prospective clients at the end of each shallow-water presentation." What began as a routine, 1994 meeting in London with shallow-water customer, British Borneo Oil and Gas, resulted in a fateful meeting with Borneo's Chief Executive and Chief Financial Officers. British Borneo had broadened their corporate strategy to include deepwater projects just prior to that '94 meeting, and Atlantia sold their first two Seastar platforms. The first went into production in 1998, delivering 35,000 barrels of crude oil per day. Ultimately, Seastar customers included British Borneo, BHP – Billiton, as well as supermajors Chevron and Total. Also as testament to Dr. Kibbee's vision and creativity, about 100 foreign and U.S. patents were ultimately granted to Atlantia based on its deepwater technology.

In 2001 Atlantia's three partners decided to sell to IHC Caland, a public Dutch company. Pat

and Joe soon retired, but Steve remained with SBM Offshore, an IHC company headquartered in Monaco, until his retirement in 2015. In recognition of its phenomenal success, Atlantia was inducted into the SBIR Hall of Fame at ceremonies in Washington, D.C. in January.

As one of only 19 companies ever honored, Atlantia joins former SBIR grantees and Hall of Famers such as Genzyme, Illumina, and Qualcomm. As Steve modestly puts it, "I guess they had to offset recognition of companies that work at the sub-microscopic level, with an organization that built large structures."

Steve remains busy in retirement. He travels from his home in Texas to Kansas about six times a year to play golf with his high school classmates, visit with friends from grade school, and manage his farm in Lenexa. When asked to share his wisdom with engineers early in their careers, he suggests "find a mentor in your field who has sympathy and concern about your career," and "put your emphasis on finding opportunities for professional growth over the long run, not on the starting salary." Priceless advice from a true innovator, entrepreneur, and visionary of the oil and gas industry.



Dr. Steve Kibbee (center) representing Atlantia at its induction into the SBIR Hall of Fame at the White House Executive Office Building on January 10, 2017. Former Small Business Administration chief Maria Contreras-Sweet and SBA Associate Administrator Mark Walsh are also shown.

KUME *Impact*

We congratulate the following individuals for their contributions to, and recognition by the university, national, and international communities.

- Sean Rackoski graduated in May of 2017 with his B.S. in Mechanical Engineering. A 6'-7" starting pitcher on the KU baseball team, Sean received KU's Forrest Hoglund Student-Athlete Award for 2016. In 2015 Sean was named to the Academic All-Big 12 First Team. Forrest Hoglund, one of the four original distinguished alumni of KUME, also played baseball at KU and graduated with his BSME degree in 1956.
- Steve Soper, Foundation Distinguished Professor, and Candan Tamerler, Wesley G. Cramer Professor, have begun their first year of service on the KU Center for Research (KUCR) Board of Trustees. KUCR is a not-for-profit research foundation that oversees all research operations at KU, and is governed by the Board of Trustees.
- Karan Surana, Deane E. Ackers Distinguished Professor, is the lead author of *The Finite Element Method for Boundary Value Problems*, published by CRC Press in 2017. The textbook is intended to provide students and researchers with the necessary concepts of applied mathematics, reinforced through application of the finite element method to various engineering problems.
- KUME faculty members have been co-inventors on 7 U.S. patents over the past two years. Our most recent inventors include Huazhen Fang for "Method for estimating a state of charge of batteries" and "Method for estimating state of charge for lithium-ion batteries," Lisa Friis for "Simplified spine testing device," Gibum Kwon for "Superhydrophilic and oleophobic porous materials and methods for making and using the same," Steve Soper for "In vitro capture and analysis of circulating tumor cells," and Candan Tamerler for "Reagents and methods for treating dental disease" as well as "Polypeptides and their use."
- Paulette Spencer, Ackers Distinguished Professor, is the lead editor of *Material-Tissue Interfacial Phenomena*, published by Woodhead in 2017. Intended for a diverse audience of engineers, scientists, and clinical practitioners, the book provides an in depth review of the state of the art in the repair and reconstruction of dental and craniofacial tissues.
- Chris Depcik, Docking Associate Professor, was one of five presenters at the 2016, *KU Elevate: Innovation in Action* event held at Wichita's National Center for Aviation Training and hosted by Chancellor Gray-Little. Depcik's TED Talk-style presentation was entitled "Efficient biofuel engines key to future autos" and is available online.
- Lisa Friis, Professor, is the editor of *Mechanical Testing of Orthopaedic Implants*, published by Woodhead in 2017. The book is a detailed resource for bioengineers, mechanical engineers, and professionals in orthopaedic implant development and in teaching.
- Ted Bergman, Charles E. & Mary Jane Spahr Professor, is lead author of *Fundamentals of Heat and Mass Transfer*, the 8th edition of which was published by John Wiley and Sons in 2017. The text is used by mechanical, chemical, and nuclear engineering students, as well as engineering practitioners, worldwide.
- Carl Luchies, Associate Professor, received the 2016 American Society of Engineering Educators (ASEE) Midwest Section Outstanding Teaching Award for innovative classroom instruction. Along with students Molly McVey and Adrian Villicana, Luchies received the Best Paper Award at the 2017 ASEE Annual Conference and Exposition in Columbus, Ohio.

2016 Graduates Graduate Students

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Akhbari, Bardiya
Al-Saedi, Akeel Aigb Abdulla
Bramlette, Richard Brooks
Eboch, William Maxwell

Hu, Bin
Kantamneni, Dasaradh
Kedari, Sayali Ravindra
Khadka, Dipin
Nanda, Anurag

Pacey, Mark Daniel
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Walther, Hans Wolfgang
Yang, Shin

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Algarra, Nathan Daniel
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Baker, Gretchen Hess
Baker, Nicholas Andrew
Bang, Hyeseung
Bargas, Jesse D
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Betancourt, Jose Maria
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Boppart, Andrew Michael
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Bruce, Jacob T
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On the Cover: Chancellor Bernadette Gray-Little in the 2015 Mechanical Engineering FSAE race car

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