ABOUT INTERPRO
Michigan Interdisciplinary and Professional Engineering (InterPro) develops and delivers programs and services that enable engineers, managers, and technical professionals to be more effective, productive, and competitive. InterPro extends and enhances the programs, capabilities, and relationships of the faculty and affiliates of the College of Engineering by offering graduate degree programs, distance learning, non-credit public short courses, professional certification programs, and conferences.

USING THE RIGHT MEMS PACKAGING IS CRITICAL FOR PRODUCT SUCCESS
MEMS packaging is a significant part of product cost. This program highlights key considerations in developing application-specific packaging that will meet goals for product performance, durability, and total cost.

Learn about extension of existing technology, exciting new technologies, how to make MEMS packaging more specific to applications, key research in emerging areas, and more.

Examples of the strengths and trade-offs of various packaging schemes will be discussed.

PACKAGING FOR MEMS

Professional development short courses and certification programs include:
- Six Sigma Certification
- Transactional
- Manufacturing
- Healthcare
- Design for Six Sigma Certification
- Toyota Kata
- Lean-Six Sigma Certification
- Lean Manufacturing Certification
- Lean Product Development Certification
- Lean Office Certification
- Lean Healthcare Certification
- Lean Supply Chain for Healthcare Certification
- Lean Supply Chain & Warehouse Management Certification
- Lean Pharmaceutical Certification
- Michigan Human Factors Engineering Short Course
- Design & Control of Hybrid Vehicles

Graduate degree programs currently offered include:
- Automotive Engineering
- Design Science
- Energy Systems Engineering
- Engineering Sustainable Systems
- Financial Engineering
- Global Automotive and Manufacturing Engineering
- Integrated Microsystems
- Manufacturing Engineering
- Pharmaceutical Engineering
- Robotics and Autonomous Vehicles

Graduate Certificates of Advanced Studies in Engineering (CASE) are also available in some of the programs.

To learn more about InterPro programs, visit InterPro.engin.umich.edu, send an email to MEnline@umich.edu or call (734) 647-7200.

Register Online Today: InterPro.engin.umich.edu
ABOUT WIMS
The Center for Wireless Integrated MicroSystems (WIMS) is a world leader in developing packaging technology for a variety of MEMS systems. For more information about WIMS including education, research highlights, patents, and publications see www.wimserc.org.

COURSE DESCRIPTION
Attendees will gain an understanding of the purpose of MEMS packaging, how it differs from IC packaging, and the techniques, processes, and equipment available to obtain the desired application-specific package. This includes packages for biomedical applications and harsh environment packages for industrial, defense, and aerospace uses.

The course addresses techniques for packaging (wafer level and die), packaging equipment, and device testing. Specific examples of MEMS packages will be used to illustrate the equipment and processes to be considered for MEMS devices. Various packaging schemes will be presented as well as their strengths and shortcomings.

Supplier and vendor activities in support of MEMS and future packaging trends will be discussed and information on the status of MEMS packaging and its evolution will be presented.

WHO SHOULD ATTEND
- Product design engineers
- Engineering managers of MEMS device manufacturers
- Engineers, managers, and system designers who use MEMS devices in their products

$1,200* COVERS THE TWO-DAY PROGRAM
Fee includes tuition, instructional materials, continental breakfast, lunch and a coffee break. Fee is payable in advance.* Upon registration, you will receive email confirmation including directions to the program site and recommended lodging.

GROUP DISCOUNT
Registration of five or more individuals qualifies an organization for a group discount. Call (734) 647-7200 or email MEonline@umich.edu to learn more.

HOW TO REGISTER
Visit the InterPro website at InterPro.engin.umich.edu, send an email to MEonline@umich.edu or call (734) 647-7200

PROGRAM COMPONENTS

DAY 1
- Introduction
- What is the Purpose of MEMS Packaging (Encapsulation, Mechanical, Chemical Protection, Electrical I/O etc)
- Electrical/Mechanical/Thermal Considerations with Examples
- Example Pressure Sensor Packaging
- Example Chem/Bio Protection (Implantable Devices)
- Dicing and Die Separation
- Die Separation Example
- Handling and Package Types
- Die Attach
- Chip on Board
- Example: Die Attach Problems
- Wire Bonding
- Flip Chip

DAY 2
- Sealing, Vacuum Packaging, Leakrate
- Example: Vacuum Packaging
- Example: Hot Bolometer Vacuum Packaging
- Thin Film Sealing Thin Film Packages (Evaporated Metal, Polysilicon, etc.)
- Solder Bonding
- Paralyene Bonding
- Au:Si Eutectic Wafer Bonding
- Example: Infrared Devices
- Example: Michigan WIMS Cube
- MEMS Testing
- Example: Michigan WIMS Cube
- Example: Infrared Devices
- Future Packaging
- Vendors, Suppliers, and Conclusion

* Program fee at the time of brochure printing. Check our current program fee schedule at InterPro.engin.umich.edu. Fee subject to change. Pricing not valid for onsite or custom programs.
ABOUT WIMS
The Center for Wireless Integrated MicroSystems (WIMS) is a world leader in developing packaging technology for a variety of MEMS systems. For more information about WIMS including education, research highlights, patents, and publications see www.wimserc.org.

COURSE DESCRIPTION
Attendees will gain an understanding of the purpose of MEMS packaging, how it differs from IC packaging, and the techniques, processes, and equipment available to obtain the desired application-specific package. This includes packages for biomedical applications and harsh environment packages for industrial, defense, and aerospace uses.

The course addresses techniques for packaging (wafer level and die), packaging equipment, and device testing. Specific examples of MEMS packages will be used to illustrate the equipment and processes to be considered for MEMS devices. Various packaging schemes will be presented as well as their strengths and shortcomings.

Supplier and vendor activities in support of MEMS and future packaging trends will be discussed and information on the status of MEMS packaging and its evolution will be presented.

WHO SHOULD ATTEND
- Product design engineers
- Engineering managers of MEMS device manufacturers
- Engineers, managers, and system designers who use MEMS devices in their products

$1,200* COVERS THE TWO-DAY PROGRAM
Fee includes tuition, instructional materials, continental breakfast, lunch and a coffee break. Fee is payable in advance.* Upon registration, you will receive email confirmation including directions to the program site and recommended lodging.

GROUP DISCOUNT
Registration of five or more individuals qualifies an organization for a group discount. Call (734) 647-7200 or email MEonline@umich.edu to learn more.

HOW TO REGISTER
Visit the InterPro website at InterPro.engin.umich.edu, send an email to MEonline@umich.edu or call (734) 647-7200

1 Program fee at the time of brochure printing. Check our current program fee schedule at InterPro.engin.umich.edu. Fee subject to change. Pricing not valid for onsite or custom programs.

KHALIL NAJAFI
is the Chair of Electrical and Computer Engineering, Arthur F. Thurnau Professor of Electrical Engineering and Computer Science, Schlumberger Professor of Engineering, and Professor of Biomedical Engineering. He served as the Director of the Solid-State Electronics Laboratory from 1998–2005, has been the director of NSF’s National Nanotechnology Infrastructure Network (NNIN) since 2004, and the deputy director of the NSF ERC on Wireless Integrated MicroSystems (WIMS) at the University of Michigan. He received the B.S., M.S., and the Ph.D. degree in 1980, 1981, and 1986 respectively, all in Electrical Engineering from the University of Michigan, Ann Arbor. His research interests include: micromachining technologies, micromachined sensors, actuators, and MEMS; analog integrated circuits; implantable biomedical microsystems; micropackaging; and low-power wireless sensing/actuating systems.

ANDREW “ANDY” OLIVER
has been involved in MEMS for nearly twenty years and in MEMS packaging for the past twelve. At Sandia National Laboratories in Albuquerque, he developed a wafer level packaging process for the SUMMIT surface micromachining process. He also developed a vacuum wafer level packaging processes at ICx Photonics for their MEMS infrared gas detector and acted as the technical interface for the wire bonding, die attach and encapsulation operations. Currently, at Chemiro, he is developing the electrical, gas, and fluidic interconnection scheme for a family of MEMS devices. He is an experienced instructor and has taught several courses on MEMS and MEMS packaging including graduate courses at the University of New Mexico and short courses for Sandia National Laboratories, and the Boston section of IEEE. His writings have appeared in books that include MEMS Packaging, The MEMS Handbook, and The CRC Mechanical Engineering Handbook as well as numerous journal and conference papers.

PROGRAM COMPONENTS

DAY 1
- Introduction
- What is the Purpose of MEMS Packaging (Encapsulation, Mechanical, Chemical Protection, Electrical I/O etc)
- Electrical/Mechanical/Thermal Considerations with Examples
- Example Pressure Sensor Packaging
- Example Chem/Bio Protection (Implantable Devices)
- Dicing and Die Separation
- Die Separation Example
- Handling and Package Types
- Die Attach
- Chip on Board
- Example: Die Attach Problems
- Wire Bonding
- Flip Chip

DAY 2
- Sealing, Vacuum Packaging, Leakrate
- Example: Vacuum Packaging
- Example: Hot Bolometer Vacuum Packaging
- Thin Film Sealing Thin Film Packages (Evaporated Metal, Polysilicon, etc.)
- Solder Bonding
- Paralyene Bonding
- Au:Si Eutectic Wafer Bonding
- Example: Anodic Bonding
- Example: Wafer Bonding
- Example: Glass Frit
- MicroFluidics
- Example: MicroFluidics
- MEMS Packaging Equipment
- MEMS Testing
- Example: Michigan WIMS Cube
- Example: Infrared Devices
- Future Packaging
- Vendors, Suppliers, and Conclusion

Wireless intraocular pressure sensors on a U.S. penny.
PACKAGING FOR MEMS

USING THE RIGHT MEMS PACKAGING IS CRITICAL FOR PRODUCT SUCCESS

MEMS packaging is a significant part of product cost. This program highlights key considerations in developing application-specific packaging that will meet goals for product performance, durability, and total cost.

Learn about extension of existing technology, exciting new technologies, how to make MEMS packaging more specific to applications, key research in emerging areas, and more.

Examples of the strengths and trade-offs of various packaging schemes will be discussed.

Graduate degree programs currently offered include:
- Automotive Engineering
- Design Science
- Energy Systems Engineering
- Engineering Sustainable Systems
- Financial Engineering
- Global Automotive and Manufacturing Engineering
- Integrated Microsystems
- Manufacturing Engineering
- Pharmaceutical Engineering
- Robotics and Autonomous Vehicles

Graduate Certificates of Advanced Studies in Engineering (CASE) are also available in some of the programs.

To learn more about InterPro programs, visit InterPro.engin.umich.edu, send an email to MEonline@umich.edu or call (734) 647-7200.

This program is a joint presentation by
- U-M Electrical Engineering and Computer Science
- The Center for Wireless Integrated MicroSystems (WIMS)
- The Center for Professional Development

Register Online Today: InterPro.engin.umich.edu