

The University of Texas at Arlington Research Institute (UTARI) is dedicated to research and innovation that leads to technology-based economic development for the DFW Metroplex, the state of Texas, and our nation.

UTARI provides innovative, affordable solutions to complex technical problems for small companies and large corporations alike. We create and develop technology, produce prototypes, and drive technology with commercial potential into the marketplace.

UTARI supports the entrepreneurial ecosystem by collaborating with start-ups, corporations, government, and academia to deliver innovative solutions to real-world challenges.

\$14M+
 in new awards over
 the past **5** years

20+
 research
 organizations

FY20 collaborations

30+ businesses

15+
 government
 agencies



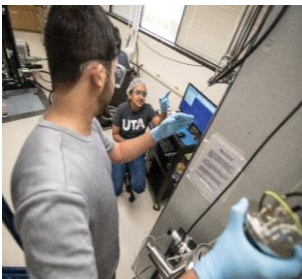
Automation and Intelligent Systems
 Control systems, robotics, automation

Army: Object Detection on Water
NSF: Control for Powered Prosthetic Legs
Air Force: Image Segmentation for Missile Attitude Estimation



Biomedical Technologies
 Prevention, diagnostics, treatment, rehabilitation, assistive care

CDMRP: REHEAL Glove for Wound Care
NIH: Foot Ulcer Prevention
NIH: Neural Electrode Array for Hypertension



Institute for Predictive Performance Methodologies

Performance prediction tools for materials and material systems

Air Force: Modeling for Sustainable Composites
Air Force: Development of Fatigue Modeling
Large Corporations: Bonded Composite Structures

Collaborate with UTARI

- ❖ Dedicated researchers with multidisciplinary skill-sets focused on project time, budget, and quality deliverables
- ❖ Partnerships with faculty experts
- ❖ State-of-the-art facilities and equipment
- ❖ Bridge the gap between early stage research and product development
- ❖ Technology transfer through licensing
- ❖ Over 30+ years of experience with government contracts

For Inquires:
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RESEARCH INSTITUTE

Partnering With UTARI

WHY PARTNER WITH UTARI?

- ❖ Dedicated full-time researchers with multidisciplinary skill-sets focused on project time, budget and quality deliverables
- ❖ Partnerships with faculty experts at UTA
- ❖ State-of-the-art facilities and equipment
- ❖ Technology transfer through licensing

INDUSTRY

UTARI partners with industry to address real-world challenges through a number of methods. We are creative at developing opportunities to partner with industry in advancing technologies. Our partnerships come in multiple forms, whether collaborating on research grants, sponsored research, or through gift distribution.

GOVERNMENT

UTARI partners with federal, state and local government agencies to develop technologies that find solutions to government challenges, whether it is the health & safety of our military, efficient transportation, or technologies for first responders.

SMALL BUSINESSES

UTARI partners with entrepreneurs to bring their innovations to the marketplace. Whether helping businesses develop their technologies or businesses licensing UTARI technologies, we can help expedite commercialization and manage technology transfer through licensing.



Consortium Grant w/ Spin-off:
Low-volume manufacturing for negative-pressure wound therapy glove to speed healing and regain motion of the hand



Collaboration on Air Force STTR:
UAVs and artificial intelligence for surveying



Small, Local Business Sponsored Research:
Control & Communication for Coordination of Multiple UAVs

LOCKHEED MARTIN



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The mission of the Automation and Intelligent Systems Division at UTARI is to develop robotics and automation tools to solve real-world problems.

AUTONOMOUS VEHICLES AND SYSTEMS

UTARI researchers develop navigation and control algorithms for a wide variety of vehicles and tasks. Recent research has included coordinated swarm and formation control, uninterrupted coverage by UAVs that autonomously relieve each other when batteries are low, and inspection of towers, bridges, and roads.

SERVICE ROBOTICS

UTARI researchers have pursued a variety of research tasks with two compliant humanoid robots (safe for interaction near humans) and multiple mobile manipulators. Recent efforts focus on nursing assistant robots to automatically retrieve objects from storage rooms for human workers and providing support to patients as they amble during recovery.

MACHINE VISION

We have established research in estimating the motion (position, rotation, velocity, etc.) of objects moving in view of a camera or the motion of the camera itself. We have conducted research in vision based localization and mapping, in which robot systems maintain an estimate of their location in an environment while building and maintaining a useful map. We have also leveraged advances in machine learning to detect and classify objects of interest, such as accurately spotting drones for security applications.



ADVANCED MANUFACTURING

Since its inception, UTARI has focused on advanced manufacturing, designing bespoke manufacturing cells, investigating methods to improve efficiency of manufacturing systems, and creating new manufacturing technologies and capabilities. Recent efforts incorporated machine learning and vision to sort products moving on a conveyer belt and development of vision and robot control methods to print materials, including metal, directly onto curved objects.

CONTROL SYSTEMS AND ESTIMATION

We focus on establishing stability of control algorithms, performance and safety guarantees, and robustness to unmodelled system dynamics, disturbances and intermittent communication. Our research in this field lies at the intersection of robust, adaptive, and optimal control, real-time learning and decision making, distributed algorithms, and applied mathematics.



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Automation and Intelligent Systems Division Head

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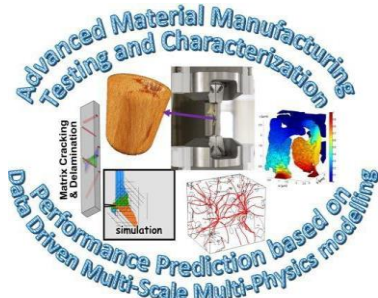
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The Institute for Predictive Performance Methodologies (IPPM) is a unique resource focused on performance prediction for advanced composites and materials through development of special material analysis, characterization, and assessment methods that enable the prediction of future performance on the basis of current condition. IPPM specializes in heterogeneous materials including: polymer, metal, and ceramic based composites for structural, electrochemical, chemical processing, nuclear fuels and nuclear waste storage, and chemical processing applications.

VISION

To reduce the cost in the conception, development, and application of engineered materials and structures, and the risk of using them in society.

APPROACH

Predictive performance based on operational observables and knowledge-based models to reduce development and maintenance cost, time to market, and risk.

AREAS OF INTEREST AND COMPETENCY

- ❖ Applied science and engineering for the study and testing of life expectancy of heterogeneous and composite materials
- ❖ Application areas: Aerospace, Automotive, Defense, Biomedical, Energy

IPPM PRINCIPAL INVESTIGATORS:

- ❖ **Dr. Endel Iarve, IPPM Director, Professor of Mechanical and Aerospace Engineering:** discrete damage modeling methodologies, integrated computational materials science and engineering.
- ❖ **Dr. Kenneth Reifsnider, NAE, IPPM Founder, Presidential Distinguished Professor of Mechanical and Aerospace Engineering:** maintenance of advanced materials and composites with emphasis on zero maintenance and infinite life concepts.
- ❖ **Dr. Ye Cao, Assistant Professor of Materials Science and Engineering:** multiscale (DFT and phase-field) modeling and machine learning of microstructure evolution and charge transport in nanomaterials for electronic and energy applications
- ❖ **Dr. Rassel Raihan, Assistant Professor of Mechanical and Aerospace Engineering:** Multi-physical predictive performance of multi-scale degradation mechanisms, material state change, durability and data driven prognosis of heterogeneous material systems.
- ❖ **Dr. Xin Liu, Assistant Professor of Industrial Engineering:** data-driven multiscale modeling of composite materials and structures.



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UTARI's Biomedical Technologies Division focuses on developing clinically relevant devices and systems that can be utilized by health care providers, as well as patients, to enhance diagnostics, treatment, rehabilitation, and preventive care.

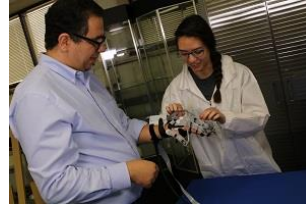
REHABILITATION TECHNOLOGIES

REHAB GLOVE & UPPER EXTREMITY EXOSKELETON:

Portable, programmable and feedback controlled exoskeleton systems capable of implementing prescribed motion therapy that are commonly used in hand and upper extremity rehabilitation after surgery, stroke, or spinal cord injury, as well as for conditions such as Cerebral Palsy. Additional applications include using as assistive devices for human performance augmentation.

WOUND HEALING TECHNOLOGIES

REHEAL GLOVE: The REHEAL Glove is an advanced hand wound care system that enables delivery of localized treatments including therapeutic drug delivery and Negative Pressure Wound Therapy (NPWT). The REHEAL glove is made with a flexible polymer to allow for motion therapy during healing in order to aid in functional restoration of the hand.



INJURY PREVENTION TECHNOLOGIES

SMART CUSHION & BED: These systems monitor and modulate pressure and shear between the body and a support surface. The smart cushion aims to reduce pressure injuries among wheelchair users, while the bed and shoe systems are designed to minimize the occurrence of facility acquired pressure injuries and diabetic foot ulcers, respectively.

IMPACT REDUCTION LINERS: An interconnected fluid-filled cell based liners for helmet and other protective gears for reducing force and acceleration transfer for reducing the effect of blunt impact. The main application include using as a helmet liner for reducing concussion in sports and military scenarios.



National Institutes of Health



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KEY FEATURES**Three Therapy Modes in One System**

- ❖ Continuous Passive Motion
- ❖ Compensatory Assisted Motion
- ❖ Active Resistance Motion

Evidence Based Optimal Therapy

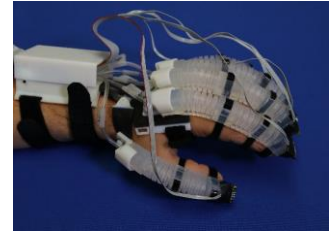
- ❖ Quantifiable diagnostics
- ❖ Progress monitoring
- ❖ Remote access and data logging

Affordable and Usable

- ❖ Light weight and portable
- ❖ Easy-to-use and safe
- ❖ Low-cost

ABOUT THE TECHNOLOGY

Motion therapies are widely used in post-surgical and post-stroke rehabilitation. The University of Texas at Arlington's patented soft robotic actuators enable the REHAB Glove to match anatomical motion within small joint sizes with the degree of control necessary for hand rehabilitation. The REHAB Glove achieves these goals with additional safety and less complexity while reducing cost compared to traditional rigid robotic systems.



The REHAB Glove is a portable feedback controlled, and programmable system capable of implementing prescribed therapeutic schemes developed by healthcare professionals. Each digit includes a state-of-the-art inertial measurement sensor to monitor the joint motion during flexion and extension. Applied torque and its resulting joint-angle motion provide data for progress monitoring and evaluation. Remote monitoring and adjustment enable therapists to prescribe, monitor, and evaluate therapy outside of the traditional clinical setting.



*In collaboration with: University of North Texas
Health Science Center*

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KEY FEATURES**Two Therapy Modes in One System**

- ❖ Continuous Passive Motion
- ❖ Compensatory Assisted Motion

Evidence Based Optimal Therapy

- ❖ Quantifiable diagnostics
- ❖ Progress monitoring
- ❖ Remote access and data logging

Affordable and Usable

- ❖ Light weight, wearable, and portable
- ❖ Easy-to-use and safe
- ❖ Low-cost

ABOUT THE TECHNOLOGY

Motion therapies are widely used in post-surgical, post-burn, and neurological rehabilitation. The University of Texas at Arlington's patent-pending Upper Extremity Exoskeleton provides motion therapy by assisting the well-coordinated movement of upper extremity joints. The exoskeleton built using soft robotic technology offers a higher degree of human compliance with improved safety at a reduced cost in comparison to traditional rigid robotic systems.



Upper Extremity Exoskeleton is a portable, feedback-controlled, and programmable system capable of assisting fingers, wrist, and elbow motion. The exoskeleton allows the implementation of prescribed therapeutic schemes developed by healthcare professionals. Control schemes implemented with the exoskeleton enable coordinated joint motion for training activities of daily living. Sensor-based applied torque and its resulting joint-angle motion provide data for progress monitoring and evaluation. Remote monitoring and adjustment enable therapists to prescribe, monitor, and evaluate therapy outside of the traditional clinical setting.

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KEY FEATURES**Function of the Glove**

- ❖ Applies Negative Pressure Wound Therapy to the hand
- ❖ Allows drug and wound cleansing agent delivery
- ❖ Stabilizes skin grafts by conforming to the hand and applying uniform pressure

Benefits for Improved Patient Outcomes

- ❖ Allows early motion therapy during wound healing
- ❖ Non-adherent to new tissue growth
- ❖ Transparent for easy wound visualization

ABOUT THE TECHNOLOGY

The REHEAL Glove is an advanced hand wound care system that enables delivery of localized treatments including therapeutic drug delivery and Negative Pressure Wound Therapy (NPWT). This wound care system is comprised of a glove-shaped wound dressing and control unit that delivers the therapeutics and applies negative pressure. The flexible and transparent polymer-based glove is designed to fit the size and shape of an injured hand with strategically placed fluid exchange ports for NPWT, wound irrigation, and therapeutic delivery.



Current NPWT involves foam-based dressings which have significant limitations in their clinical utility for hand wounds including: poor fit to hands, difficulty achieving vacuum seal, and hand immobilization leading to stiffness. These foam dressings are adherent to new tissue growth, which is unintentionally removed during dressing changes. This is a critical factor in areas where the tissue mass is thin and multiple tissue types are involved in the injury. The REHEAL glove system is specifically designed to circumvent these issues by leveraging a flexible polymer substrate which prevents adhesion to the wound and allows motion during the application of NPWT.



National Institutes
of Health

*In collaboration with: University of Washington
Orthopaedics and Sports Medicine*

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KEY FEATURES**Real-time Pressure Sensing and Modulation**

- ❖ Real-time pressure mapping and recording
- ❖ Data-driven pressure modulation including pressure redistribution and offloading

Benefits for improved patient care

- ❖ Redistribution of seating interface pressure to eliminate peak pressures
- ❖ Offloading pressure from already effected areas
- ❖ Continuous care for reduced burden of caregivers
- ❖ Remote access and data logging allow for retrospective analysis

ABOUT THE TECHNOLOGY

Current wheelchair cushion options do not provide real-time mapping enabled automated pressure modulation, and thus patients and caregivers are forced to find ways to manually relieve pressures by repositioning or body weight shifting. UTA's patented modulating air-cell technology, equipped with an array of sensors, enable the Smart Seat Cushion to actively monitor and create pressure maps of a seated person and actively modulate in real-time to redistribute pressure across the sitting interface to ensure that there is no peak pressure on vulnerable areas.



Additionally, the seat cushion allows users to offload pressure from already effected areas of the body completely, then redistribute the pressure across the remainder of the sitting interface to avoid mechanical loading on bony prominence and to facilitate blood reperfusion. The Smart Seat Cushion provides a new and more effective way to prevent pressure injuries while also reducing the burden on clinicians, therapists, and caregivers.

The Smart Seat Cushion will easily accommodate most any wheelchair, and is a portable, feedback controlled, and programmable system capable of adjusting pressure levels as prescribed by healthcare professionals. Remote monitoring and adjustment enable therapists to prescribe, monitor, and evaluate patients outside of the traditional clinical setting.



In collaboration with: University of Pittsburgh

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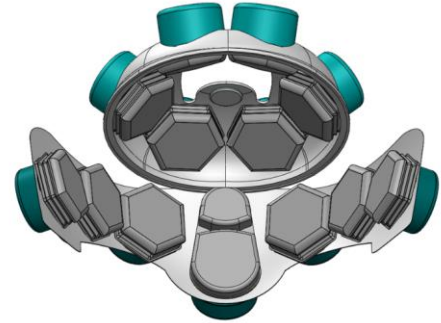
Interconnected Liner for Impact Reduction in Protective Sports Gear

KEY FEATURES

- ❖ Interconnected cell architectures allow one cell to undergo impact while the other cell aids in absorbing impact energy which reduces both force and acceleration transfer.
- ❖ Can be utilized across a variety of industries.
- ❖ Use of hyper elastic construction material for better impact absorption properties.
- ❖ Adjustable internal pressure of cells for customizing to different applications.
- ❖ Customizable arrangement into different configurations and variations of cell shape based on corresponding anatomical location.

ABOUT THE TECHNOLOGY

The inventors have developed an impact reduction liner concept which is based on fluid-filled interconnected cell architecture. This development can be configured for a helmet or protective body (chest) gear to prevent the occurrence of impact-related injuries. When cells are subjected to an external mechanical force, they deform, and fluid within the system moves into other cells which expand accordingly to accommodate incoming fluid. The efficient function of the invented construction is provided by the specifically designed geometries and connections of impact-receiving and impact-absorbing cells. Following an impact, the impact-receiving cell is compressed and deformed resulting in fluid within the system moving into the impact-absorbing cell. The fluid motion and the expansion of the impact-absorbing cell will reduce the direct force and acceleration transfer from the impact to the head or other protected body part. The geometry of the system is designed to reduce both linear and rotational acceleration due to an impact.



TECHNOLOGY NEED

While sports have become cornerstones of the world's pastimes, the safety gear that players use season after season has not changed in the last 30-40 years despite routinely poor safety evaluations for helmets on the market by a variety of professional leagues. In a world full of constant innovation and invention, safety technology needs to catch up. There is a noticeable lack of innovation in the underlying principles that allow sports helmets to function at optimal performance. While strong advocates like the National Football League (NFL) are pushing for more research into safety, there are issues with the current framework that many sports helmets are based upon. There are an estimated 1.6 - 3.8 million sports and recreation-related concussions that occur in the United States each year. The global smart helmet market size was valued at \$372.4 million in 2018 and is expected to expand at a compound annual growth rate of 18.6% from 2019 to 2025. Strict road safety regulations established by the government, growing adoption of advanced wearable technology, and awareness regarding personal safety are expected to drive the demand for the advancement in protective gear.

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