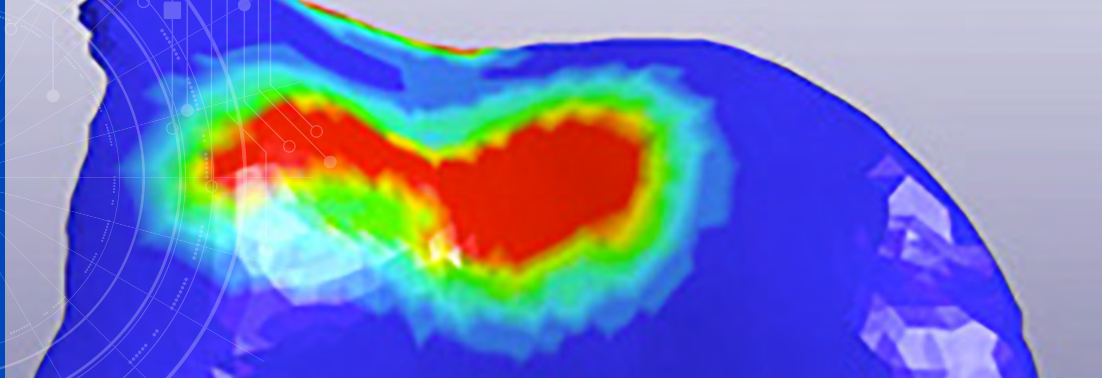
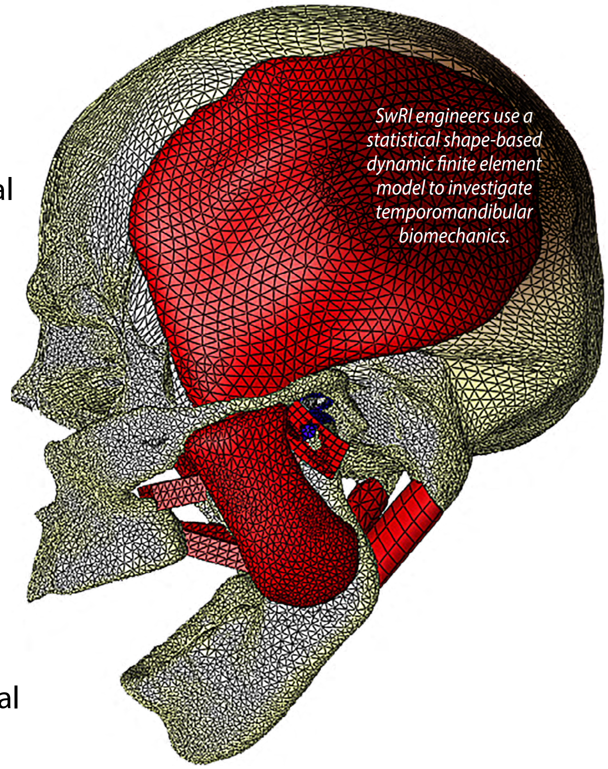


Computational Musculoskeletal Modeling

Southwest Research Institute® (SwRI®) offers expertise in advanced computational modeling to understand the mechanics of complex musculoskeletal conditions. Engineers in the Musculoskeletal Biomechanics Section have more than 35 years of experience in developing and applying advanced computational and experimental methods, including:



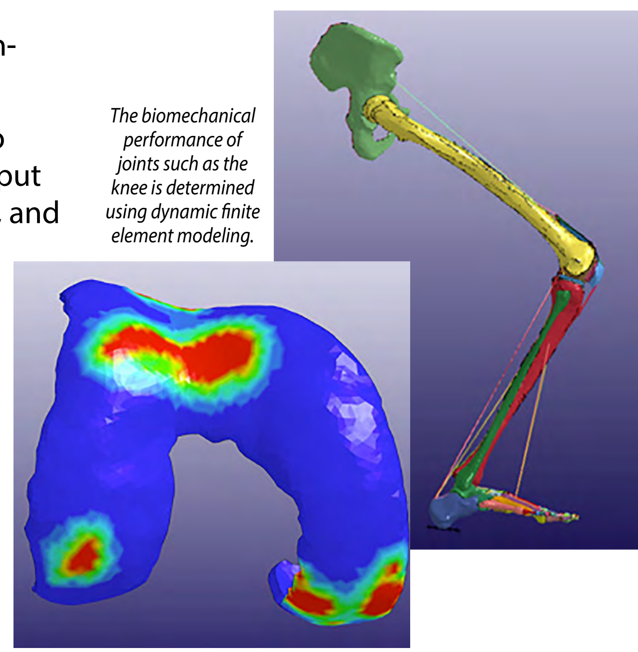
SwRI engineers use a statistical shape-based dynamic finite element model to investigate temporomandibular biomechanics.

- Statistical shape modeling-based finite element analysis
- Advanced computational constitutive model development
- Risk of musculoskeletal disease initiation and progression
- Musculoskeletal injury risk prediction
- Clinical bone fracture risk assessment

Probabilistic Mechanics and Reliability Methods

SwRI's musculoskeletal biomechanics engineers use advanced probabilistic mechanics and reliability methods to address how the inherent variability and uncertainty associated with human biological systems affect predictions of system performance and functionality. These methods include:

- Imaging-based methods of defining subject-specific or specimen-specific finite element models
- Parametric and probabilistic finite element modeling methods to investigate the effect of variation and/or uncertainty in model input parameter definition (i.e., geometry, material properties, loading, and boundary conditions) on predicted outcome
- Experimental verification and validation methods at multiple-length scales ranging from ultra- and microstructural characterization to continuum-level biological material behavior to musculoskeletal performance at the whole-body level
- Implementation and development of statistical shape and density/trait modeling methods that allow sophisticated analyses of variation within a population
- Description of variability in bone shape and traits in both cross-sectional and longitudinal studies

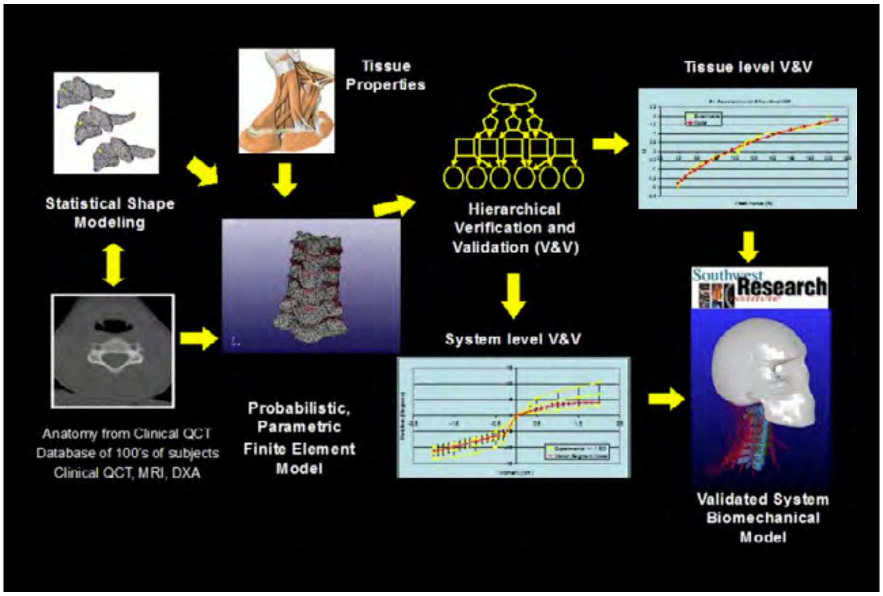


The biomechanical performance of joints such as the knee is determined using dynamic finite element modeling.

Applications

SwRI's biomechanics engineers develop and apply advanced computational and unique experimental techniques to address a variety of musculoskeletal biomechanics-related problems, including:

- Osteoporosis
- Osteoarthritis
- Bone fracture risk
- Musculoskeletal injury risk
- Musculoskeletal implant failure risk



SwRI engineers use advanced probabilistic mechanics and reliability methods to address how the inherent variability and uncertainty associated with biological systems affect predictions of biomechanical performance and functionality. In one application, the probability of injury to the cervical spine (neck) of naval aviators caused by high acceleration maneuvers is being investigated.

We welcome your inquiries.
For more information, please contact:

Daniel P. Nicolella, Ph.D.
Institute Engineer & Manager
Musculoskeletal Biomechanics Section
210.522.3222
daniel.nicolella@swri.org

Materials Engineering Department
Mechanical Engineering Division

biomechanics.swri.org

SOUTHWEST RESEARCH INSTITUTE

Southwest Research Institute® is a premier independent, nonprofit research and development organization. With eleven technical divisions, we offer multidisciplinary services leveraging advanced science and applied technologies. Since 1947, we have provided solutions for some of the world's most challenging scientific and engineering problems.

An Equal Employment Opportunity/Affirmative Action Employer
Race/Color/Religion/Sex/Sexual Orientation/Gender Identity/National Origin/Disabled/Veteran
Committed to Diversity in the Workplace

210.522.2122

ask@swri.org

Like. Share. Follow. Listen.

swri.org

Designed & printed by SwRI MPS 18-0623 JCN 269897 tp