

Biomechanics of Brain Trauma

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[Mary Jane Neer Fund for Research in Disability]



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Jeffery Pike



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Biomechanics of the Brain Karol Miller, 2011-08-09 Biomechanics of the Brain will present an introduction to brain anatomy for engineers and scientists Experimental techniques such as brain imaging and brain tissue mechanical property measurement will be discussed as well as computational methods for neuroimage analysis and modeling of brain deformations due to impacts and neurosurgical interventions Brain trauma between the different sexes will be analyzed Applications will include prevention and diagnosis of traumatic injuries such as shaken baby syndrome neurosurgical simulation and neurosurgical guidance as well as brain structural disease modeling for diagnosis and prognosis This book will be the first book on brain biomechanics It will provide a comprehensive source of information on this important field for students researchers and medical professionals in the fields of computer aided neurosurgery head injury and basic biomechanics

Biomechanics of the Brain Karol Miller, 2019 With contributions from scientists at major institutions this book presents an introduction to brain anatomy for engineers and scientists It provides for the first time a comprehensive resource in the field of brain biomechanics

Mathematical Modelling and Biomechanics of the Brain Corina Drapaca, Siv Sivaloganathan, 2019-09-06 This monograph aims to provide a rigorous yet accessible presentation of some fundamental concepts used in modeling brain mechanics and give a glimpse of the insights and advances that have arisen as a result of the nascent interaction of the mathematical and neurosurgical sciences It begins with some historical perspective and a brief synopsis of the biomedical biological manifestations of the clinical conditions diseases considered Each chapter proceeds with a discussion of the various mathematical models of the problems considered starting with the simplest models and proceeding to more complex models where necessary A detailed list of relevant references is provided at the end of each chapter With the beginning research student in mind the chapters have been crafted to be as self contained as possible while addressing different clinical conditions and diseases The book is intended as a brief introduction to both theoreticians and experimentalists interested in brain mechanics with directions and guidance for further reading for those who wish to pursue particular topics in greater depth It can also be used as a complementary textbook in a graduate level course for neuroscientists and neuroengineers

Multiscale Biomechanical Modeling of the Brain Mark F. Horstemeyer, Raj K. Prabhu, 2021-10-27 Multiscale Biomechanical Modeling of the Brain discusses the constitutive modeling of the brain at various length scales nanoscale microscale mesoscale macroscale and structural scale In each scale the book describes the state of the experimental and computational tools used to quantify critical deformational information at each length scale Then at the structural scale several user based constitutive material models are presented along with real world boundary value problems Lastly design and optimization concepts are presented for use in occupant centric design frameworks This book is useful for both academia and industry applications that cover basic science aspects or applied research in head and brain protection The multiscale approach to this topic is unique and not found in other books It includes meticulously

selected materials that aim to connect the mechanistic analysis of the brain tissue at size scales ranging from subcellular to organ levels Presents concepts in a theoretical and thermodynamic framework for each length scale Teaches readers not only how to use an existing multiscale model for each brain but also how to develop a new multiscale model Takes an integrated experimental computational approach and gives structured multiscale coverage of the problems

The Brain Jeffrey A Pike, 2011-09-08 Nearly 50 000 Americans die from brain injuries annually with approximately half of all Traumatic Brain Injuries TBI being transportation related TBI is a critical and ever evolving safety topic with equally important components of injury prevention consequences and treatment This book is part of a 3 volume set which presents a comprehensive look at recent head injury research and focuses on injury of the head s contents and features 13 technical papers These publications are primarily related to injuries to the brain its surrounding membranes and its blood supply Editor Jeffrey A Pike has selected the most relevant technical papers spanning the early 1990s through the beginning of 2011 including several older papers which provide an essential historical perspective Each volume in the series also includes a table of references arranged by topic and a new chapter tying together anatomy injury and injury mechanism topics Buy the Set and Save Head Injury Biomechanics The three volume set consists of these individual volumes Head Injury Biomechanics Volume 1 The Skull Head Injury Biomechanics Volume 2 The Brain Head Injury Biomechanics Volume 3 Mitigation

Correlation of Skull Deformation and Brain Biomechanics Under Blunt Impacts Hesam Moghaddam, 2017 Traumatic brain injury TBI is a major health concern as about 2.9 million people TBI in the United States every year Fall accidents and sports are major causes of impact induce TBI While many finite element FE head models have been developed to understand the biomechanics of TBI under impact the majority of them have overlooked the effect of skull deformation on the biomechanical responses of brain during blunt impacts To this end a FE study was carried out to investigate the correlation of skull deformation with brainu2019s tissue responses under blunt impact North Dakota State University Finite Element Head Model NDSUFEHM was used to investigate the pressure and stress responses of the brain under different impact conditions The impacts were carried out at a 45° tilted orientation using two different impact velocity 10 m/s and 13 m/s which resulted in a total of two different impact scenarios LS Dyna nonlinear FE solver and LS PrePost were employed to perform all simulations record data and visualize results Specifically the intracranial pressure ICP maximum shear stress MSS were recorded and analyzed for two different impact velocities These biomechanical responses were recorded at different locations on and inside the brain to starting from the impact site coup to the opposite site countercoup This was done to analyze the variations of ICP and MSS through the brain in order to understand the role of these parameters in injury mechanisms The impact severity was shown to have more effect on the level of pressure response while its effect on peak MSS was not much ICP variation was linear between coup and countercoup sites It was observed that unlike pressure shear stress traveled slower through the brain tissue Our findings suggested that using only one biomechanical parameter canu2019t justify the fidelity of the FE head

models Neural Tissue Biomechanics Lynne E. Bilston, 2011-07-23 Damage to the central nervous system resulting from pathological mechanical loading can occur as a result of trauma or disease Such injuries lead to significant disability and mortality The peripheral nervous system while also subject to injury from trauma and disease also transduces physiological loading to give rise to sensation and mechanotransduction is also thought to play a role in neural development and growth This book gives a complete and quantitative description of the fundamental mechanical properties of neural tissues and their responses to both physiological and pathological loading This book reviews the methods used to characterize the nonlinear viscoelastic properties of central and peripheral neural tissues and the mathematical and sophisticated computational models used to describe this behaviour Mechanisms and models of neural injury from both trauma and disease are reviewed from the molecular to macroscopic scale The book provides a comprehensive picture of the mechanical and biological response of neural tissues to the full spectrum of mechanical loading to which they are exposed This book provides a comprehensive reference for professionals involved in pre prevention of injury to the nervous system whether this arises from trauma or disease **Forensic Neuropathology and Associated Neurology** Manfred Oehmichen, Roland N. Auer, Hans Günter König, 2006 The present volume deals with specific aspects of neuropathology for forensic and clinical neuropathologists with particular emphasis on their relevance to everyday practice Each chapter includes an overview of the literature as well as specific references and features a wealth of figures graphs and tables *Advances in Brain Mechanics* Silvia Budday, Philip Bayly, Gerhard A. Holzapfel, 2022-02-04 **Head Injury Biomechanics, the Brain** Jeffery Pike, 2011 Nearly 50 000 Americans die from brain injuries annually with approximately half of all Traumatic Brain Injuries TBI being transportation related TBI is a critical and ever evolving safety topic with equally important components of injury prevention consequences and treatment This book is part of a 3 volume set which presents a comprehensive look at recent head injury research and focuses on injury of the head s contents and features 13 technical papers These publications are primarily related to injuries to the brain its surrounding membranes and its blood supply Editor Jeffrey A Pike has selected the most relevant technical papers spanning the early 1990s through the beginning of 2011 including several older papers which provide an essential historical perspective Each volume in the series also includes a table of references arranged by topic and a new chapter tying together anatomy injury and injury mechanism topics

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