

1. Record Nr.	UNINA9910876505903321
Autore	Srivastava Jay Prakash
Titolo	Mechanical Engineering in Biomedical Application : Bio-3D Printing, Biofluid Mechanics, Implant Design, Biomaterials, Computational Biomechanics, Tissue Mechanics
Pubbl/distr/stampa	Newark : , : John Wiley & Sons, Incorporated, , 2024 ©2024
ISBN	1-394-17510-8 1-394-17509-4
Edizione	[1st ed.]
Descrizione fisica	1 online resource (438 pages)
Altri autori (Persone)	RanjanVinayak KozakDrazan KumarRanjan KumarPankaj TayalShubham
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Cover -- Title Page -- Copyright Page -- Contents -- Preface -- Acknowledgments -- Part I: Additive Manufacturing -- Chapter 1 The Role of Additive Manufacturing Technologies for Rehabilitation in Healthcare and Medical Applications -- 1.1 Introduction -- 1.2 Classification of the Additive Manufacturing Process -- 1.2.1 Jetting-Based Bioprinting -- 1.2.2 Extrusion-Based Bioprinting -- 1.2.3 Laser-Assisted Bioprinting -- 1.2.4 Laser-Based Stereolithography -- 1.3 AM Materials for Medical Applications -- 1.4 Biomedical and Healthcare Applications of AM -- 1.5 Conclusion and Future Outlook -- References -- Chapter 2 Artificial Recreation of Human Organs by Additive Manufacturing -- 2.1 Introduction -- 2.2 Role of Additive Manufacturing for Human Organs -- 2.3 Role of Artificial Recreation -- 2.3.1 Decellularized Organ Regeneration -- 2.3.2 3D Bioprinting of Organs and Cells -- 2.3.3 Self-Healing and Shape Memory for Artificial Organs -- 2.4 Role of Additive Manufacturing in Orthopedics -- 2.5 Types of Bioadditive Manufacturing -- 2.5.1 Classification of Organoids

Using AM -- 2.6 Conclusion -- References -- Chapter 3 Advances, Risks, and Challenges of 3D Bioprinting -- 3.1 Introduction -- 3.2 3D Bioprinting -- 3.2.1 Types of 3D Bioprinting -- 3.3 Biomaterials and Bioinks -- 3.4 Applications of 3D Bioprinting -- 3.5 A Case Study -- 3.6 Conclusions -- References -- Chapter 4 Laser-Induced Forward Transfer for Biosensor Application -- 4.1 Introduction -- 4.2 Biosensor -- 4.2.1 History/Background -- 4.2.2 Types of Biosensors -- 4.2.2.1 Potentiometric Biosensors -- 4.2.2.2 Amperometric Biosensors -- 4.2.2.3 Impedimetric Biosensors -- 4.2.2.4 Conductometric Biosensors -- 4.2.3 Biosensor Manufacturing Processes -- 4.3 Laser-Induced Forward Transfer (LIFT) -- 4.3.1 History and Process Description -- 4.3.2 Process Parameters -- 4.3.2.1 Fluence of Lasers. 4.3.2.2 Film-Acceptor Substrate Distance -- 4.3.2.3 Material Selection -- 4.3.2.4 Pulse Characteristics of Lasers -- 4.3.2.5 Laser Spot Size -- 4.4 Laser-Induced Forward Transfer for Biosensor Manufacturing -- 4.5 Outlook and Conclusion -- References -- Part II: Biomaterials -- Chapter 5 The Effect of the Nanostructured Surface Modification on the Morphology and Biocompatibility of Ultrafine-Grained Titanium Alloy for Medical Application -- 5.1 Introduction -- 5.1.1 Titanium-Based Materials for Biomedical Application -- 5.1.2 Ultrafine-Grained Titanium-Based Materials Obtained by Severe Plastic Deformation (SPD) -- 5.1.3 Electrochemical Anodization of Titanium-Based Materials -- 5.2 Materials and Methods -- 5.2.1 High-Pressure Torsion Process -- 5.2.2 Electrochemical Anodization -- 5.2.3 Characterization of the Surface Topography by Atomic Force Microscopy (AFM) -- 5.2.4 Biocompatibility Examination -- 5.3 Results and Discussion -- 5.3.1 The Microstructure of the Ultrafine-Grained Two-Phase Ti-13Nb-13Zr Alloy -- 5.3.2 Morphology of Nanostructured Surfaces of the Materials -- 5.3.3 Characterization of the Surface Topography -- 5.3.4 Biocompatibility Examination -- Conclusions -- Acknowledgments -- References -- Chapter 6 Powder Metallurgy-Prepared Ti-Based Biomaterials with Enhanced Biocompatibility -- 6.1 Introduction -- 6.2 Powder Metallurgy of Ti-Based Materials -- 6.2.1 Powder Metallurgy of Ti and Ti Alloys -- 6.2.2 Powder Metallurgy of Ti-Based Composites -- 6.2.2.1 Porosity of PM Ti-Based Materials -- 6.2.2.2 Effect of Reinforcing Particles on the Biological Behavior of Ti-Based Composites -- 6.3 Laser Surface Treatment of Materials for Enhanced Human Cell Osteodifferentiation -- 6.3.1 Laser-Treated Surfaces of PM Ti-Based Materials -- Conclusion -- Acknowledgments -- References. Chapter 7 Total Hip Replacement Response to a Variation of the Radial Clearance Through In Silico Models -- 7.1 Introduction -- 7.2 The Musculoskeletal Multibody Model -- 7.2.1 Kinematical Analysis -- 7.2.2 Dynamical Analysis -- 7.2.3 The Muscle Actuator -- 7.2.4 The Geodesic Muscle Wrapping -- 7.2.5 The Hill Muscle-Tendon Model -- 7.2.6 The Static Optimization -- 7.3 The Lubrication/Contact Model -- 7.3.1 The Hip Joint -- 7.3.2 The Reynolds Equation -- 7.3.3 Numerical Resolution -- 7.3.4 Coupling Models -- 7.4 Simulations -- 7.4.1 Gait Cycle Results -- 7.4.2 Tribological Results -- 7.4.3 Radial Clearance Sensitivity Analysis -- 7.5 Conclusions -- References -- Chapter 8 Techniques of Biopolymer and Bioceramic Coatings on Prosthetic Implants -- 8.1 Introduction -- 8.2 Driving Factors for the Application of Coatings -- 8.2.1 Corrosion of Metal Implants and Its Categories -- 8.2.1.1 Uniform Attack -- 8.2.1.2 Fretting Corrosion -- 8.2.1.3 Galvanic Corrosion -- 8.2.1.4 Pitting Corrosion -- 8.2.1.5 Crevice Corrosion -- 8.2.1.6 Leaching -- 8.2.1.7 Stress Corrosion Cracking (SCC) -- 8.2.2 Bioactivity of the Surface -- 8.2.2.1 Immune Rejection, Osteoinduction, Osteoconduction, and Osseointegration -- 8.2.2.2 Toxicity and Bacterial Biofilm Formation -- 8.3 The Development of

Implant Coatings -- 8.3.1 Strategies for Coating the Implants -- 8.4
Conclusions -- References -- Chapter 9 Mechanical Behavior of
Bioglass Materials for Bone Implantation -- 9.1 Introduction on Bio
Materials -- 9.2 Aim and Objective of the Work -- 9.3 Role of REEs
(CeO₂, La₂O₃, and Sm₂O₃) -- 9.4 Uses of Rare Earth Elements -- 9.5
Biomaterials -- 9.6 Simulated Body Fluid -- 9.7 Bioactive Glasses --
9.8 Bioactive Composites -- 9.9 Area of Biomaterials -- References --
Chapter 10 Biomedical Applications of Composite Materials -- 10.1
Introduction.
10.2 Different Types of Composites Used in Biomedical Applications --
10.3 Application of Composites in Tissues -- 10.4 Application of
Composites in Dentistry -- 10.5 Application of Composites in Total
Joint Replacements -- 10.6 Application of Composites in Hip Joint
Replacement -- Conclusions -- References -- Part III: Biofluid
Mechanics -- Chapter 11 Materials Advancement, Biomaterials, and
Biosensors -- 11.1 Introduction -- 11.2 Design of Biomaterials -- 11.3
Polymers -- 11.4 Metals as Biomaterials -- 11.5 Bioactive Material and
Concept of Bioactivity -- 11.6 Biocompatibility of the Titanium Binder
Element -- 11.7 Classification -- 11.8 Interaction Between Biomaterials
and Biological Systems -- 11.9 Biomaterials: Protein Surface
Interactions -- 11.10 Dental Material Cavity Fillers -- 11.11 Bridges,
Crowns, and Dentures -- 11.12 Bone Fractures -- 11.13 Biosensors --
11.14 Biosensor Classification -- 11.14.1 Resonant Biosensor --
11.14.2 Optical Biosensors -- 11.14.3 Surface Plasmon Resonance
(SPR) Biosensor -- 11.14.4 Piezoelectric Biosensors -- 11.14.5 Thermal
Biosensors -- 11.14.6 Electrochemical Biosensors -- 11.14.7
Bioluminescence Sensors -- 11.14.8 Nucleic Acid-Based Biosensors --
11.14.9 Nanobiosensors -- 11.14.10 Microbial Biosensors -- 11.14.11
Bioreceptor-Based Category -- 11.14.12 Transducer-Based Category
-- 11.15 Biosensors: Precursors of Contemporary Biomaterial
Succession -- 11.15.1 Carbon-Based Nanomaterials -- 11.15.2 Carbon
Nanotubes -- 11.15.3 Electrochemical Biosensors Based on Carbon
Nanotubes -- 11.15.4 Carbon Nanotube-Based Immunosensors --
11.15.5 Optical Sensors Composed of Carbon Nanotubes -- 11.15.6
Graphene-Based Biosensors -- 11.15.7 Electrochemical Biosensors
Based on Graphene -- 11.15.8 Graphene-Based Immunosensors --
11.15.9 Graphene-Modulated Gene Biosensors -- 11.15.10 Conductive
Polymers -- 11.15.11 Polypyrrole.
11.15.12 Polythiophene -- 11.15.13 Polyaniline and Its Byproducts --
11.15.14 Polyacetylene -- References -- Chapter 12 Blockage Study in
Carotid Arteries -- 12.1 Introduction -- 12.2 Numerical Model and Its
Implementation -- 12.2.1 Geometry -- 12.2.2 Meshing and GIT --
12.2.3 Governing Equations -- 12.2.4 Boundary Conditions -- 12.3
Results and Discussion -- 12.3.1 Effect of Blockage on Blood Flow
Velocity -- 12.3.2 Effect of Blood Flow Velocities on Wall Stress --
12.3.3 Effect of Stenosis on Dynamic Pressure Distribution -- 12.3.4
Effect of Stenosis on Viscosity and Mass Imbalance -- 12.4 Conclusion
-- References -- Chapter 13 Mechanical Properties of Human Synovial
Fluid: An Approach for Osteoarthritis Treatment -- 13.1 Introduction
-- 13.1.1 Synovial Fluid -- 13.1.2 Structure and Composition of
Synovial Fluid -- 13.2 Osteoarthritis and Its Treatments -- 13.3
Viscosupplements -- 13.3.1 Hylan G-F 20 -- 13.3.2 Sodium
Hyaluronate -- 13.3.3 Hyaluronan -- 13.4 Synovial Mimic Fluid/PVP --
13.5 Conclusion -- References -- Chapter 14 Artificial Human Heart
Biofluid Simulation as a Boon to Humankind: A Review Study -- 14.1
Introduction -- 14.2 Biofluid Simulation -- 14.3 Heart Valve Fluid Flow
-- 14.4 Artificial Heart as a Boon to Humankind -- 14.5 Conclusion --
References -- Part IV: Robotics -- Chapter 15 Robotics in Medical

Science -- 15.1 Introduction -- 15.2 Minimally Invasive Surgery (MIS)
-- 15.3 Human-Robot Interaction -- 15.4 Robotic Manipulation --
15.5 The Role of Human-Computer Interaction (HCI) -- 15.6 Soft
Robotics in Medicine -- 15.7 Haptics in Medicine -- 15.8 Automation
and Control -- 15.9 Dental -- 15.10 CAD/CAM -- 15.11 Conclusion --
References -- Chapter 16 A Research Perspective on Ankle-Foot
Prosthetics Designs for Transtibial Amputees -- 16.1 Introduction --
16.2 Biomechanics of Biological Ankle and Foot -- 16.3 Prosthetic Foot.
16.3.1 Design of Passive Prosthetic Ankle-Foot.
