

Rehabilitation engineering

Introduction

The term rehabilitation engineering means “the systematic application of engineering sciences to design, develop, adapt, test, evaluate, and apply technological solutions to problems confronted by individuals with disabilities in functional areas, such as **mobility, communications, hearing, vision,** and **cognition**, and in activities associated with employment, independent living, education, and integration into the community

Content

1 INTRODUCTION

Legislation Influencing Rehabilitation Engineering, Assistive Technology, Engineering Acceptable Performance, Rehabilitation Engineering Design, Product Testing, Assistive Technology Design Criteria

2 FUNDAMENTALS OF REHABILITATION ENGINEERING DESIGN

Design Considerations, Total Quality Management in Rehabilitation Engineering, Steel as a Structural Material, Aluminum for Assistive Technology Design, Use of Composites for Assistive Technology Design, Design with Engineering Materials, Fabrication

3 BIOMECHANICS OF MOBILITY AND MANIPULATION

Human Motion Analysis, Gait Analysis, Functional Neuromuscular Stimulation for Movement Restoration, Biomechanics of Wheelchair Propulsion, Biomechanics of Seating, Biomechanics of Manipulation

4 PERSONAL TRANSPORTATION

Selecting a Vehicle, Lift Mechanisms, Wheelchair Securement Systems, Passenger Restraint Systems, Automobile Hand-Controls, Control of Secondary Functions

5 WHEELCHAIR SAFETY, STANDARDS AND TESTING

Standard Tests, Static Stability, Stability with Road Crown and Inclination, Impact Strength Tests, Fatigue Strength Tests, Finite-Element Modeling Applied to Wheelchair Design/testing, Power Wheelchair Controller Performance, Designing for Safe Operation

6 MANUAL WHEELCHAIR DESIGN

Classes of Manual Wheelchairs, Frame Design Materials, The Wheelchair and Rider, Wheels and Casters, Components, Human Factors Design Considerations, Future Directions

7 POWER WHEELCHAIR DESIGN

Classes of Power Wheelchairs, Motor Selection, Servoamplifiers, Microprocessor Control, Electromagnetic Compatibility, Batteries, Gear Boxes, User Interfaces

8 POSTURAL SUPPORT AND SEATING

Seating and Postural Support Systems, Distribution of Stresses in Soft Tissues, Seating Pressure Measurement, Control Interface Integration, Multi-Configuration Seating and Postural Support Systems

9 PROSTHETICS AND ORTHOTICS

Upper-Extremity Protheses, Upper-Extremity Orthoses, Lower-Extremity Protheses, Lower-Extremity Orthoses, Functional Neuromuscular Stimulation, Ambulation Aids, Aids to Daily Living

10 RECREATIONAL DEVICES AND VEHICLES

Racing Wheelchairs, Arm-Powered Bicycles and Tricycles, Off-Road Vehicles, Water Sports, Adaptive Ski Equipment, Recreational Vehicles

11 REHABILITATION ROBOTICS

Components and Configurations of Robots, Robot Kinematics, Robot Motion, Robot Control, Robot Sensors, Human Interfaces to Robotic Systems

Major activities in Rehabilitation Engineering

Prosthetics and Orthotics

- Artificial foot and legs
- Artificial hand, wrist, and arms
- Hand splints and upper limb braces
- Functional electrical stimulation orthoses

Assistive Devices for Persons with Visual Impairments

- Devices to aid reading and writing (e.g., closed circuit TV magnifiers, electronic Braille, reading machines, talking calculators, auditory and tactile vision substitution systems)
- Devices to aid independent mobility (e.g., Laser cane, Binaural Ultrasonic Eyeglasses, Handheld Ultrasonic Torch, electronic enunciators, robotic guide dogs)

Assistive Devices for Persons with Auditory Impairments

- Digital hearing aids
- Telephone aids (e.g., TDD and TTY)
- Lipreading aids
- Speech to text converters

Assistive Devices for Tactile Impairments

- Cushions
- Customized seating
- Sensory substitution
- Pressure relief pumps and alarms

Alternative and Augmentative Communication Devices

- Interface and keyboard emulations
- Specialized switches, sensors, and transducers
- Computer-based communication devices
- Linguistic tools and software

Manipulation and Mobility Aids

- Robotic aids
- Manual and special-purpose wheelchairs
- Powered wheelchairs, scooters, and recliners
- Adaptive driving aids
- Modified personal licensed vehicles