Where To Download Engineering Haptic Devices A Beginners Guide Springer Series On Touch And Haptic Systems Free Download Pdf

Engineering Haptic Devices Engineering Haptic Devices Engineering Haptic Devices Engineering Haptic Devices HAPTIC DEVICE DESIGN. Making Sense of Haptics Haptic Interaction Wearable Haptic Devices for Social and Virtual Interaction Haptic Interaction Low Power Haptic Devices A Virtual Reality-based Training Environment Using Haptic Interfaces Wearable Haptic Devices for Social and Virtual Interaction Haptic Human-Computer Interaction Advances in Haptics A Body-grounded Kinesthetic Haptic Device for Virtual Reality Haptic Devices and Applications Haptics Technologies Haptics: Perception, Devices and Scenarios Design and Analysis of Open-source Educational Haptic Devices Engineering Haptic Devices Multi-finger Haptic Interaction Encyclopedia of Multimedia Haptics for Virtual Reality and Teleoperation Controlling a Passive Haptic Master During Bilateral Teleoperation Enabling Precise Control of a Haptic Device Haptic Interaction Haptic Devices for Studies on Human Grasp and Rehabilitation Implementation of Haptic Devices in Computer Aided Engineering Applications Haptic Interfaces for Accessibility, Health, and Enhanced Quality of Life Haptic Devices in Medical Applications Effective Development of Haptic Devices Using a Model-based and Simulation-driven Design Approach Haptics: Perception, Devices, Control, and Applications Analysis, Development, and Control of Multi-degree-of-freedom Passive Haptic Devices Haptics: Perception, Devices, Control, and Applications Transparent Navigation with Impedance Type Haptic Devices An Investigation of Temporal and Spatial Limitations of Haptic Devices Performance Metrics for Haptic Interfaces The Synthesis of Three Dimensional Haptic Textures: Geometry, Control, and Psychophysics Haptics Rendering and Applications Haptics

This book is the first resource to provide in-depth coverage on topical areas of assistive, rehabilitative, and health-related applications for haptic (touch-based) technologies. Application topics are grouped into thematic areas spanning haptic devices for sensory impairments, health and well-being, and physical impairments which are illustrated in this book. A diverse group of experts in the field were invited to contribute different chapters to provide complementary and multidisciplinary perspectives. Unlike other books on haptics, which focus on human haptic perception, specific modalities of haptics (e.g., realistic haptic rendering), or broadly cover the subfields of haptics, this book takes an application-oriented approach to present a tour of how the field of haptics has been advanced with respect to important, impactful thematic focuses. Under Theme 1 “Sensory Impairments”, haptics technologies to support individuals with sensory impairments is presented which includes: Spatial awareness in sensory impairments through touch; Haptically-assisted interfaces for persons with visual impairments; and Enabling learning experiences for visually impaired children by interaction design. Under Theme 2 “Haptics for Health and Well-Being”, haptics technologies aimed at supporting exercise and healthy aging will be covered including: Haptics in rehabilitation, exergames and health; Therapeutic haptics for mental health and well-being; and Applications of haptics in medicine. Under Theme 3 “Haptics for Physical Impairments”, haptics technologies for enhancing the quality of life for individuals with weakened/impaired limbs or neurological diseases impacting movement is targeted including: Assistive soft exoskeletons with pneumatic artificial muscles; Haptics for accessibility in rehabilitative hardware; and intelligent robotics and immersive displays for enhancing haptic interaction in physical rehabilitation environments. Engineers, scientists, and researchers working in the areas of haptics, multimedia, virtual/augmented/mixed-reality, human-computer interaction, assistive technologies, rehabilitative technologies, healthcare technologies, and/or actuator design will want to purchase this book. Advanced level students and hobbyists interested in haptics will also be interested in this book. The sense of touch is fundamental during the interaction between humans and their environment; in virtual reality, objects are created by computer simulations and they can be experienced through haptic devices. In this context haptic textures are fundamental for a realistic haptic perception of virtual objects. This book formalizes the specific artefacts corrupting the rendering of virtual haptic textures and offers a set of simple conditions to guide haptic researchers towards artefact-free textures. The conditions identified are also extremely valuable when designing psychophysical experiments and when analyzing the significance of the data collected. The Synthesis of Three Dimensional Haptic Textures, Geometry, Control, and Psychophysics examines the problem of rendering virtual haptic textures with force feedback devices. The author provides an introduction to the topic of haptic textures that covers the basics of the physiology of the skin, the psychophysics of roughness perception, and the engineering challenges behind haptic textures rendering. The book continues with the presentation of a novel mathematical framework that characterizes haptic devices, texturing algorithms and their ability to generate realistic haptic textures. Finally, two psychophysical experiments link the perception of roughness with the parameters of the haptic rendering algorithms. This book formalizes the specific artefacts corrupting the rendering of virtual haptic textures and offers a set of simple conditions to guide haptic researchers towards artefact-free textures. The conditions identified are also extremely valuable when designing psychophysical experiments and when analyzing the significance of the data collected. This is an open access book. In this third edition of Engineering Haptic Devices the software part was rewritten from scratch and now includes even more details on tactile and texture interaction modalities. The kinematics section was improved to extend beyond a pure knowledge explanation to a comprehensive guideline on how to actually do and implement haptic kinematic functions. The control section was reworked incorporating some hands-on experience on control implementation on haptic systems. The system, actuator and sensor design chapters were updated to allow easier access to the content. This book is written for students and engineers faced with the development of a task-specific haptic system. Now 14 years after its first edition, it is still a reference for the basics of haptic interaction and existing haptic systems and methods as well as an excellent source of information for technical questions arising in the design process of systems and components. Following a system engineering approach, it is divided into two parts with Part I containing background and reference information as a knowledge basis. Typical application areas of haptic systems and a thorough analysis of haptics as an interaction modality are introduced. The role of users in the design of haptic systems is discussed and relevant design and development stages are outlined. Part II presents all related challenges in the design of haptic systems including general system architecture and control structures, kinematics, actuator principles and all types of sensors you may encounter doing haptic device development. Beside these hardware and mechanical topics, further chapters examine state-of-the-art interfaces to operate the devices, and hardware and software development to push haptic systems to their limits. Haptics technology is being used more and more in different applications, such as in computer games for increased immersion, in surgical simulators to create a realistic environment for training of surgeons, in surgical robotics due to safety issues and in mobile phones to provide feedback from user action. The existence of these applications highlights a clear need to understand performance metrics for haptic interfaces and their implications on device design, use and application. Performance Metrics for Haptic Interfaces aims at meeting this need by establishing standard practices for the evaluation of haptic interfaces and by identifying significant performance metrics. Towards this end, a combined physical and psychophysical experimental methodology is presented. Firstly, existing physical performance measures and device characterization techniques are investigated and described in an illustrative way. Secondly, a wide range of human psychophysical experiments are reviewed and the appropriate ones are applied to haptic interactions. The psychophysical experiments are unified as a systematic and complete evaluation method for haptic interfaces. Finally, synthesis of both evaluation methods is discussed. The metrics provided in this state-of-the-art volume will guide readers in evaluating the performance of any haptic interface. The generic methodology will enable researchers to experimentally assess the suitability of a haptic interface for a specific purpose, to characterize and compare devices quantitatively and to identify possible improvement strategies in the design of a system. Kinesthetic haptic devices can make us feel that we are touching or holding objects that are not actually there by applying a force directly onto a user’s body. As a corollary of Newton’s third law, these devices are typically attached to the ground or else they would not be able to apply a net force onto a user. Thus, kinesthetic haptic devices typically have small workspaces–the area in which they can be used–or are overly cumbersome and expensive. Consequently, they are incompatible with room-scale virtual reality, which allows users to move and walk within a room. The portable haptics interface overcomes this limitation because its wearable form factor means it's "grounded" directly to a user's back, making it portable. In other words, this device approximates the sensations of a kinesthetic haptic device while also being portable. The haptic device consists of a robotic arm that is mounted on a user's back, and its end-effector is attached to an HTC Vive controller, enabling use with virtual reality. A first example application uses the portable haptics interface to simulate the elasticity of a bow and arrow as a user pulls on the bowstring of a virtual bow. A second application renders haptic feedback for impacts by applying an impulse of in the appropriate direction when a user hits a tennis ball with a racket in virtual reality. In an evaluation, we asked users to shoot targets in virtual reality with and without haptic feedback. Our results suggest that haptic feedback increases spatial presence with a large effect size but does not affect involvement and experienced realism. Our results also suggest several improvements to the ergonomics of the system such as using thicker straps to better distribute the load. In summary, portable kinesthetic haptic devices such as the portable haptics interface provide room-scale virtual reality applications with the sense of touch without constraining users to a chair. This book constitutes the proceedings of the third international conference AsiaHaptics 2018, held in Songdo, Korea. It presents the state-of-the-art of the diverse haptics (touch)-related research, including perception and illusion, development of haptics devices, and applications to a wide variety of fields such as education, medicine, telecommunication, navigation and entertainment. This book is a valuable resource not only for active haptics researchers, but also for general readers wishing to understand the status quo in this interdisciplinary area of science and technology. Haptic interfaces are divided into two main categories: force feedback and tactile. Force feedback interfaces are used to explore and modify remote/virtual objects in three physical dimensions in applications including computer-aided design, computer-assisted surgery, and computer-aided assembly. Tactile interfaces deal with surface properties such as roughness, smoothness, and temperature. Haptic research is intrinsically multi-disciplinary, incorporating computer science/engineering, control, robotics, psychophysics, and human motor control. By extending the scope of research in haptics, advances can be achieved in existing applications such as computer-aided design (CAD), tele-surgery, rehabilitation, scientific visualization, robot-assisted surgery, authentication, and graphical user interfaces (GUI), to name a few. Advances in Haptics presents a number of recent contributions to the field of haptics. Authors from around the world present the results of their research on various issues in the field of haptics. Welcome to the proceedings of the 6th EuroHaptics 2008 conference held in Madrid, June 10–13, 2008 under the auspices of the Universidad Politécnica de Madrid. EuroHaptics conferences have been held in Europe, initially annually, now on a biennial basis, since the first one at the University of Birmingham in 2001. The promotion of the European haptics community by the Eurohaptics Society (www. eurohaptics. org) integrates a multidisciplinary group of researchers with a wide range of interests stemming from backgrounds in technical, scientific, educational and artistic disciplines. The regular congregation of individuals around the topic of haptics has led to many fruitful and successful interactions that have developed across the EuroHaptics conferences. Moreover, this community now enjoys links to researchers around the rest of the world through the WorldHaptics conference series, of which EuroHaptics is proud to be a sponsoring partner. Such links offer increased possibilities for collaboration which can only bring us greater successes in our endeavours to understand the nature of haptics. June 2008 Alan Wing President of EuroHaptics Society IEEE Technical Committee on Haptics (TCH) http://www. worldhaptics. org/ The IEEE Technical Committee on Haptics (TCH) is co-sponsored by the IEEE Robotics & Automation Society and the IEEE Computer Society. The mission of the TCH is to integrate the diverse interests of the highly interdisciplinary haptics community and to improve communication among the different research areas. ABSTRACT Haptic devices are used to provide multi-modal data transfer between haptic users and computers in virtual reality applications. They enable humans to take force and tactile feedback from any virtual or remote objects. Haptic devices also facilitate the use of data collected from a real object in the virtual environment. Usage of the haptic devices increase more and more in industrial, educational and medical applications in parallel with development of virtual reality technology. As virtual reality technology requires interdisciplinary study with related to its application areas, it creates a lot of different specific working areas (Haptic interface design, freeform model, surgical operations in virtual environment etc.). Especially, some complex modifications which require hand-working can be performed with the system having great potential in medical applications (Brain surgery without error and operations which require great skill etc.). This is only one of the implementations of haptic devices in digital environment. Aim of this study is to design and manufacture a 7 DOF (degrees of freedom) haptic device which serves the mentioned application areas. All different haptic devices in literature have maximum 6 DOF. The designed 7 DOF haptic device has about 20% extra working space and more flexible working capability compared to the other haptic devices with the similar link lengths and joint limitations. This study is important in terms of the development of haptic devices in the world as well as spreading of haptic devices and its applications in Turkey. Haptic human-computer interaction is interaction between a human computer user and the computer user interface based on the powerful human sense of touch. Haptic hardware has been discussed and exploited for some time, particularly in the context of computer games. However, so far, little attention has been paid to the general principles of haptic HCI and the systematic use of haptic devices for improving efficiency, effectiveness, and satisfaction in HCI. This book is the first one to focus on haptic human-computer interaction. It is based on a workshop held in Glasgow, UK, in August / September 2000. The 22 revised full papers presented were carefully reviewed and selected from 35 submissions. Besides a brief historic survey, the book offers topical sections on haptic interfaces for blind people, collaborative haptics, psychological issues and measurement, and applications of haptics. This book covers all topics relevant for the design of haptic interfaces and teleoperation systems. The book provides the basic knowledge required for understanding more complex approaches and more importantly it introduces all issues that must be considered for designing efficient and safe haptic interfaces. Topics covered in this book provide insight into all relevant components of a haptic system. The reader is guided from understanding the virtual reality concept to the final goal of being able to design haptic interfaces for specific tasks such as nanomanipulation. The introduction chapter positions the haptic interfaces within the virtual reality context. In order to design haptic interfaces that will comply with human capabilities at least basic understanding of human sensors-motor system is required. An overview of this topic is provided in the chapter related to human haptics. The book does not try to introduce the state-of-the-art haptic interface solutions because these tend to change quickly. Only a careful selection of different kinematic configurations is shown to introduce the reader into this field. Mathematical models of virtual environment, collision detection and force rendering topics are strongly interrelated and are described in the next two chapters. The interaction with the virtual environment is simulated with a haptic interface. Impedance and admittance based approaches to haptic robot control are presented. Stability issues of haptic interaction are analyzed in details and solutions are proposed for guaranteeing stable and safe operation. Finally, haptic interaction is extended to teleoperation systems. Virtual fixtures which improve the teleoperation and human-robot cooperation in complex environments are covered next and the last chapter presents nanomanipulation as one specific example of teleoperation. Multi-finger Haptic Interaction presents a panorama of technologies and methods for multi-finger haptic interaction, together with an analysis of the benefits and implications of adding multiple-fingers to haptic applications. Research topics covered include: design and control of advanced haptic devices; multi-contact point simulation algorithms; interaction techniques and implications in human perception when interacting with multiple fingers. These multi-disciplinary results are integrated into applications such as medical simulators for training manual skills, simulators for virtual prototyping and precise manipulations in remote environments. Multi-finger Haptic Interaction presents the current and potential applications that can be developed with these systems, and details the systems' complexity. The research is focused on enhancing haptic interaction by providing multiple contact points to the user. This state-of-the-art volume is oriented towards researchers who are involved in haptic device design, rendering methods and perception studies, as well as readers from different disciplines who are interested in applying multi-finger haptic technologies and methods to their field of interest. Tactile perception and haptics are essential for us, as we gain information about structures and surface properties of physical objects by using the sense of touch. Haptics also enables us to manipulate the physical world. The emphasis of this book is put on technologies for artificially deceiving our haptic perception. First, examples and a definition of haptics from a physiological point of view are given. Thereby, one focus is on cases of loss of haptics in everyday professional routine, in order to emphasize the impact of haptics. Then, an overview of products with extraordinary haptic properties leads to a more precise terminology. In the second part of the book, concrete technical aspects of haptic manipulation and manipulators are considered beginning with higher-level subjects like control and kinematics and proceeding with a detailed discussion of actuators and sensors and the interfaces to and from the mechanical environment. In the final chapter fundamental software engineering is introduced, including haptic interaction in virtual reality simulations. "Engineering Haptic Devices" is intended to be a reference book for technologies of haptic relevance as well as a textbook on methods of haptic engineering and applications.It is addressed to students and professionals of engineering disciplines or natural sciences. Stability and transparency are key design requirements in haptic devices. Replacing conventional electric motors with passive actuators such as brakes or dampers can improve both stability and transparency as passive actuators can display a wide range of impedance while guaranteeing stability. However, passive haptic devices suffer from a serious drawback; their force output is difficult to control. This issue was addressed extensively for planar manipulators but devices with higher degrees-of-freedom (DOF) have not been examined. This thesis proposes a generalized framework for analyzing and controlling higher-DOF devices and examining the effects of the kinematic structure on the force output capability. A first of its kind 3-Degree-of-Freedom (DOF) parallel passive haptic device was developed along with a novel controller designed specifically for the 3-DOF passive device. This thesis also investigates the use of a nonlinear disturbance observer to aid in the control of passive haptic devices. In this greatly reworked second edition of Engineering Haptic Devices the psychophysic content has been thoroughly revised and updated. Chapters on haptic interaction, system structures and design methodology were rewritten from scratch to include further basic principles and recent findings. New chapters on the evaluation of haptic systems and the design of three exemplary haptic systems from science and industry have been added. This book was written for students and engineers that are faced with the development of a task-specific haptic system. It is a reference book for the basics of haptic interaction and existing haptic systems and methods as well as an excellent source of information for technical questions arising in the design process of systems and components. Divided into two parts, part 1 contains typical application areas of haptic systems and a thorough analysis of haptics as an interaction modality. The role of the user in the design of haptic systems is discussed and relevant design and development stages are outlined. Part II presents all relevant problems in the design of haptic systems including general system and control structures, kinematic structures, actuator principles and sensors for force and kinematic measures. Further chapters examine interfaces and software development for virtual reality simulations. There has been significant progress in haptic technologies but the incorporation of haptics into virtual environments is still in its infancy. A wide range of the new society's human activities including communication, education, art, entertainment, commerce and science would forever change if we learned how to capture, manipulate and reproduce haptic sensory stimuli that are nearly indistinguishable from reality. For the field to move forward, many commercial and technological barriers need to be overcome. By rendering how objects feel through haptic technology, we communicate information that might reflect a desire to speak a physically-based language that has never been explored before. Due to constant improvement in haptics technology and increasing levels of research into and development of haptics-related algorithms, protocols and devices, there is a belief that haptics technology has a promising future. Haptic technology, or haptics, is a tactile feedback technology that takes advantage of a user's sense of touch by applying forces, vibrations, and/or motions to the user. This mechanical stimulation may be used to assist in the creation of virtual objects (objects existing only in a computer simulation), for control of such virtual objects, and for the enhancement of the remote control of machines and devices (teleoperators). It has been described as ""(doing) for the sense of touch what computer graphics does for vision."" Although haptic devices are capable of measuring bulk or reactive forces that are applied by the user, it should not be confused with touch or tactile sensors that measure the pressure or force exerted by the user to the interface. Haptic technology has made it possible to investigate in detail how the human sense of touch works by allowing the creation of carefully controlled haptic virtual objects. These objects are used to systematically probe human haptic capabilities, which would otherwise be difficult to achieve. These new research tools contribute to the understanding of how touch and its underlying brain functions work. This book is your ultimate resource for Haptics. Here you will find the most up-to-date information, analysis, background and everything you need to know. In easy to read chapters, with extensive references and links to get you to know all there is to know about Haptics right away, covering: Haptic technology, Justin (robot), Affective Haptics, BlackBerry Storm, BlackBerry Storm 2, DualShock, Feelie, Haptic media, List of games supporting force feedback, Novint, Refreshable Braille display, Rumble Pak, Stereotaxy, Telehaptic, Virtual surgery, Volumetric Haptic Display, Wired glove, Multimodal interaction, Ambient Devices, Artificial human companion, Artificial reality, Augmented virtuality, Automatic identification and data capture, Brain implant, CICS, Collaborative information seeking, Collaborative planning software, Collaborative software, Collaborative working environment, Collaborative working system, Computer supported cooperative work, Computer-mediated reality, Dialog system, E-professional, Eye tracking, EyeTap, GVU Center at Georgia Tech, Head-mounted display, Head-up display, Heliodisplay, Human-robot interaction, Hypercollaboration, IBM 2260, I-CubeX, Interaction design, Interactive media, Interactive visualization, L-EXOS, LifeClipper, Medical CSCW, Memex, Minority Report (film), Mixed reality, Modality (human-computer interaction), Mundaneum, Office of the future, Omnidirectional treadmill, OpenIllusionist, Organizational Memory System, Pixetell, Psion Teklogix, Reality-virtuality continuum, Semantic interpretation, Sensorama, Sentient computing, Sonic interaction design, Sonification, Spoken dialog system, Videoplace, Virtual retinal display, Vuzix, W3C MMI, Z800 3DVisor This book explains in-depth the real drivers and workings of Haptics. It reduces the risk of your technology, time and resources investment decisions by enabling you to compare your understanding of Haptics with the objectivity of experienced professionals. The term “haptics” refers to the science of sensing and manipulation through touch. Multiple disciplines such as biomechanics, psychophysics, robotics, neuroscience, and software engineering converge to support haptics, and generally, haptic research is done by three communities: the robotics community, the human computer interface community, and the virtual reality community. This book is different from any other book that has looked at haptics. The authors treat haptics as a new medium rather than just a domain within one of the above areas. They describe human haptic perception and interfaces and present fundamentals in haptic rendering and modeling in virtual environments. Diverse software architectures for standalone and networked haptic systems are explained, and the authors demonstrate the vast application spectrum of this emerging technology along with its accompanying trends. The primary objective is to provide a comprehensive overview and a practical understanding of haptic technologies. An appreciation of the close relationship between the wide range of disciplines that constitute a haptic system is a key principle towards being able to build successful collaborative haptic environments. Structured as a reference to allow for fast accommodation of the issues concerned, this book is intended for researchers interested in studying touch and force feedback for use in technological multimedia systems in computer science, electrical engineering, or other related disciplines. With its novel approach, it paves the way for exploring research trends and challenges in such fields as interpersonal communication, games, or military applications. Open-source hardware significantly impacts the development of technology by allowing communities of users with varied expertise to share, customize, and collectively improve on designs. Most haptic hardware available outside of the research community is proprietary and expensive. This prevents communities of users from easily obtaining, building, modifying, and learning from the devices. We propose that the ability to easily obtain, assemble and customize a haptic device is especially important for educational applications. In this work we present three open-source haptic devices, for which we carefully considered trade-offs in cost, ease of fabrication and assembly, and performance -- toward making haptic devices more accessible for educational applications. We first present Hapkit 3.0: an open-source, customizable, 3D-printed, one-degree-of-freedom (1-DOF), kinesthetic haptic device developed for science, engineering and math learning. The design of Hapkit 3.0 built on the design of two previous versions of the device (Hapkit 1.0 and Hapkit 2.0). We performed an analysis of the mechanical components of the Hapkit family of devices as well as a stiffness discrimination study using the three versions of Hapkit. From the study we found that Hapkit 3.0 outperformed the previous two versions. We applied the Hapkit family of devices in several educational environments: a middle school classroom, an online class, and undergraduate and graduate courses. We also investigated the use of Hapkit to illustrate abstract mathematical concepts for high school students, and found evidence that haptic feedback could be used to visualize mathematical functions. We then present Haplink: an open-source, 3D-printed, kinesthetic haptic device that can be used as a 1- or 2-DOF device, and where the kinematics of the 2-DOF device build on the kinematics of the 1-DOF device. Haplink was designed with the idea that students benefit from learning concepts incrementally, and that a device that itself increments from one to two degrees of freedom will aid in this process. We analyze the resolution and force capabilities of Haplink throughout its workspace and the effects of the resolution and force capabilities in rendering different virtual environments. We also describe the use of Haplink in a university freshman course on haptics, where we demonstrated the use of Haplink to teach concepts incrementally. Finally we present HapCaps: an open-source, 3D-printed, tactile haptic device for finger sense training. HapCaps are haptic buttons designed to sense a press and give a tactile cue in the form of a vibration. We used 10 HapCaps to build a system (the HapCaps System) to combine finger sense training and math learning. Using the HapCaps System, we performed a four-week study in which first graders underwent finger sense training at the same time as they were learning math. The purpose of the study was to evaluate our device in a classroom environment as well as understand the logistics of using the HapCaps System hardware in a school setting. At the same time, we looked for any improvement in finger sense and math that would emerge from a short study. As a result of the study, we found evidence that the HapCaps System can be used to improve finger perception in first graders. We also improved the design based on the results of the study. Augmented and virtual reality allow users to visually experience fantastic artificial environments. Haptic technology increases immersion and realism in these environments by allowing users to touch and interact with virtual objects. For example, using haptic technology, surgeons can practice surgical tasks in simulation and people can virtually feel a comforting touch from loved ones at distant locations. Specifically, haptic technology is the design of devices to communicate information through touch. The information could be a message from a person, robot, or virtual avatar, or the mechanical properties of a virtual object. Wearable haptic technology allows users to receive haptic information without constraining their movement in space, giving them the ability to perform other tasks simultaneously. In this talk, I will present three strategies that can be used to increase the amount of information communicated by a wearable haptic device. First, we describe, demonstrate, and validate a device framework for a body-mounted vibrotactile display. The display allows users to receive haptic signals at the forearm, where the device is mounted, and at the fingertips when the user chooses. We show that stimulating the forearm and fingertips simultaneously does not affect user performance compared to stimulating the fingertips alone when large amplitude signals are used. The display is wearable yet allows for communicating signals to the fingertips, which have the densest packing of mechanoreceptors, without impeding manipulation tasks by mounting the display directly to the finger. Next, we record subject's expressing a set of emotions to a body-mounted pressure sensor array. We describe a data-driven method to produce haptic signals based on the data recordings and we validate that the haptic signals successfully communicate emotions in a user study with a physical haptic device. The results show that a discrete representation of touch signals can be recorded and used to relay emotions to humans without training. Finally, we fabricate two 4-degree-of-freedom origami haptic devices for the fingertip that can deliver normal force, shear force, and torsion. We evaluate the performance of each device via analysis of their workspace, bandwidth, and force output. The two devices are created using novel manufacturing processes that enable affordable and scalable haptic technology for the fingertip or other locations on the body. Classically, haptic signals are designed by hand by haptics researchers or study participants; here I present strategies that enable the future of content creation for haptic devices. The combination of a body-mounted framework, a data driven approach for effective haptic signal generation, and novel 4-degree-of-freedom fingertip devices comprise a suite of hardware and software that creates compelling and lightweight wearable technology. The two-volume set LNCS 9774 and 9775 constitutes the refereed proceedings of the 10th International Conference EuroHaptics 2016, held in London, UK, in July 2016. The 100 papers (36 oral presentations and 64 poster presentations) presented were carefully reviewed and selected from 162 submissions. These proceedings reflect the multidisciplinary nature of EuroHaptics and cover topics such as perception of hardness and softness; haptic devices; haptics and motor control; tactile cues; control of haptic interfaces; thermal perception; robotics and sensing; applications. This book presents a new set of devices for accurate investigation of human finger stiffness and force distribution in grasping tasks. The ambitious goal of this research is twofold, the first is to advance the state of the art on human strategies in manipulation tasks and provide tools to assess rehabilitation procedure and the second is to investigate human strategies for impedance control that can be used for human robot interaction and control of myoelectric prosthesis. Part one describes two types of systems that are able to achieve a complete set of measurements on force distribution and contact point locations. The effectiveness of these devices in grasp analysis is also experimentally demonstrated and applications to neuroscientific studies are discussed. In part two, the devices are exploited in two different studies to investigate stiffness regulation principles in humans. The first study provides evidence on the existence of coordinated stiffening patterns in the fingers of human hands and establishes initial steps towards a real-time and effective modelling of finger stiffness in tripod grasp. The second study presents experimental findings on how humans modulate their hand stiffness whilst grasping objects of varying levels of compliance. The overall results give solid evidence on the validity and utility of the proposed devices to investigate human grasp properties. The underlying motor control principles that are exploited by humans in the achievement of a reliable and robust grasp can potentially be integrated into the control framework of robotic or prosthetic hands to achieve a similar interaction performance. This book is aimed not only at haptics and human interface researchers, but also at developers and designers from manufacturing corporations and the entertainment industry who are working to change our lives. This publication comprises the proceedings of the first International AsiaHaptics conference, held in Tsukuba, Japan, in 2014. The book describes the state of the art of the diverse haptics- (touch-) related research, including scientific research into haptics perception and illusion, development of haptics devices, and applications for a wide variety of fields such as education, medicine, telecommunication, navigation, and entertainment. Haptic devices allow a human to interact physically with a remote or virtual environment by providing tactile feedback to the user. In general haptic devices can be classified in two groups according to the energetic nature of their actuators. Devices using electric motors, pneumatic or hydraulic cylinders or other similar actuators that can add energy to the system are considered "active." Devices using brakes, clutches or other passive actuators are considered "passive" haptic devices. The research presented here focuses on the use of passive haptic devices used during teleoperation, the remote control of a "slave" device by the haptic "master" device. An actuation scheme as well as three different control methods is developed for providing the user with haptic feedback. As a final step, the effectiveness of the controllers is compared to that of a commercially available active haptic device. Twenty subjects provide data that shows the usefulness of the passive device in three typical teleoperation tasks. Augmented and virtual reality allow users to visually experience fantastic artificial environments. Haptic technology increases immersion and realism in these environments by allowing users to touch and interact with virtual objects. For example, using haptic technology, surgeons can practice surgical tasks in simulation and people can virtually feel a comforting touch from loved ones at distant locations.Specifically, haptic technology is the design of devices to communicate information through touch. The information could be a message from a person, robot, or virtual avatar, or the mechanical properties of a virtual object. Wearable haptic technology allows users to receive haptic information without constraining their movement in space, giving them the ability to perform other tasks simultaneously. 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We describe a data-driven method to produce haptic signals based on the data recordings and we validate that the haptic signals successfully communicate emotions in a user study with a physical haptic device. The results show that a discrete representation of touch signals can be recorded and used to relay emotions to humans without training.Finally, we fabricate two 4-degree-of-freedom origami haptic devices for the fingertip that can deliver normal force, shear force, and torsion. We evaluate the performance of each device via analysis of their workspace, bandwidth, and force output. The two devices are created using novel manufacturing processes that enable affordable and scalable haptic technology for the fingertip or other locations on the body.Classically, haptic signals are designed by hand by haptics researchers or study participants; here I present strategies that enable the future of content creation for haptic devices. The combination of a body-mounted framework, a data driven approach for e↲ective haptic signal generation, and novel 4-degree-of-freedom fingertip devices comprise a suite of hardware and software that creates compelling and lightweight wearable technology. The two-volume set LNCS 9774 and 9775 constitutes the refereed proceedings of the 10th

International Conference EuroHaptics 2016, held in London, UK, in July 2016. The 100 papers (36 oral presentations and 64 poster presentations) presented were carefully reviewed and selected from 162 submissions. These proceedings reflect the multidisciplinary nature of EuroHaptics and cover topics such as perception of hardness and softness; haptic devices; haptics and motor control; tactile cues; control of haptic interfaces; thermal perception; robotics and sensing; applications. This book comprises the proceedings of the second International Conference, AsiaHaptics 2016, held in Kashiwanoha, Japan. The book treats the state of the art of the diverse haptics (touch)-related research, including scientific research of haptics perception and illusion, development of haptics devices, and applications to a wide variety of fields such as education, medicine, telecommunication, navigation, and entertainment. This work helps not only active haptic researchers, but also general readers to understand what is going on in this interdisciplinary area of science and technology. Tele operation systems, in which robots are controlled remotely, are a potential solution to performing tasks in remote, small, and hazardous environments. However, there is a big disadvantage to these systems; as the direct connection between the human and the environment is lost and operators are deprived of their sense of touch. The recreation of touch feedback through haptic devices is a possible solution, however haptic devices are far from perfect and improving their design is usually a slow trial-and-error process. This book describes 7 scientific studies that try to break this slow loop by using a deductive approach. Through investigating fundamental properties of human haptic perception using psychophysical paradigms, general knowledge on haptic perception of force, position, movement and hardness was gained. The resulting information can be applied to many different haptic devices. Consequently haptic systems can be more easily designed in an intuitive, human-centered way. In this greatly reworked second edition of Engineering Haptic Devices the psychophysic content has been thoroughly revised and updated. Chapters on haptic interaction, system structures and design methodology were rewritten from scratch to include further basic principles and recent findings. New chapters on the evaluation of haptic systems and the design of three exemplary haptic systems from science and industry have been added. This book was written for students and engineers that are faced with the development of a task-specific haptic system. It is a reference book for the basics of haptic interaction and existing haptic systems and methods as well as an excellent source of information for technical questions arising in the design process of systems and components. Divided into two parts, part 1 contains typical application areas of haptic systems and a thorough analysis of haptics as an interaction modality. The role of the user in the design of haptic systems is discussed and relevant design and development stages are outlined. Part II presents all relevant problems in the design of haptic systems including general system and control structures, kinematic structures, actuator principles and sensors for force and kinematic measures. Further chapters examine interfaces and software development for virtual reality simulations. Magnetorheological brakes (MRB) with electronic control can be used in haptic devices to apply forces/torques to the user in a virtual reality (VR) simulation to increase realism. With a control device that uses a Hall sensor to calculate the magnetic field, precise control of the braking torque is possible. Many scientific studies in recent years have shown that machine learning models can be used to predict output torque using Hall sensor data. However, fluid leaks out of the MRB over time due to rubber seal failure, degrading haptic interface output and posing challenges in torque prediction. The negative impacts of fluid leaks on machine learning-based torque prediction have not been well studied, and there is no prior work on alleviating these negative impacts.In this thesis, I address this challenge by developing various machine learning-based methods for capturing the dynamic behavior of an MRB and its changing torque production as fluid leaks out. These approaches include the random forest model, which is based on decision trees, the artificial neural network model, which is based on Multi-Layer Perceptron, and the Long Short-Term Memory model, which is based on Recurrent Neural Network. Extensive experiments using data obtained from a real MRB device have been conducted, and the results show that the both the traditional machine learning approach (2-Step-RN) and the deep learning based approach (Long Short-Term Memory, i.e., LSTM) can reliably predict the output torque. It is worth noting that these approaches outperform baseline models that are trained for and work at a stable fluid level, suggesting their great potential for allowing high-fidelity torque control of MRB devices. In addition, due to various hardware limitations that may be faced, how to combine models with hardware devices is also a challenge. Hence, a lookup table solution and LSTM with interpolation method are proposed in this thesis to address the hardware challenges. "Force-feedback haptic and teleoperated applications depend upon an intricate synergy between human and machine. Humans manipulate a local device and, in doing so, interact with a virtual world or remote physical environment through the use of an avatar or slave device. Typical operation of a haptic device during simulation requires the user to perform common tasks that constitute the bases for all user actions. These common tasks include manipulation, selection, and navigation. The device dynamics of haptic systems can play a crucial role impacting the performance of the human user to perform these tasks.In this thesis we investigate the effect that the dynamic coupling of the device inertia has on user performance during navigational tasks. We derive an adaptation of the operation and admissible-motion space representation for haptic systems in which forces causing deviations from a desired path can be thought of as parasitic forces that degrade the user's performance. Dynamic simulations were carried out to gain insight into the effects of navigating along paths of varying coupling using a 2DOF five-bar mechanism and were experimentally validated. We then develop a method of systematically selecting regions of a haptic workspace to be used for navigation of large virtual environments. This procedure generates a haptic display with a highly transparent haptic manipulation region within which a user can interact with a virtual environment. This manipulation region is bounded by a well-behaved navigational region that ensures adequate force transmission. To demonstrate this technique, navigation and manipulation spaces are generated and described for the planar and spatial cases." -- This second edition provides easy access to important concepts, issues and technology trends in the field of multimedia technologies, systems, techniques, and applications. Over 1,100 heavily-illustrated pages — including 80 new entries — present concise overviews of all aspects of software, systems, web tools and hardware that enable video, audio and developing media to be shared and delivered electronically.

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