

Research Article

Robust Tracking Control of Robot Manipulators Using Only Joint Position Measurements

Ancai Zhang,¹ Jinhua She,² Xuzhi Lai,³ Min Wu,³ Jianlong Qiu,⁴ and Xiangyong Chen⁴

¹ School of Automobile Engineering, Linzi University, Linzi, Shandong 276005, China

² School of Computer Science, Tokyo University of Technology, Hachioji, Tokyo 192-0982, Japan

³ School of Information Science and Engineering, Central South University, Changsha, Hunan 410083, China

⁴ School of Science, Linzi University, Linzi, Shandong 276005, China

Correspondence should be addressed to Jinhua She; she@ntt.tsu.ac.jp

Received 13 August 2013; Accepted 23 September 2013

Academic Editor: Bo-Chao Zheng

Copyright © 2013 Ancai Zhang et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

This paper concerns the tracking control of a robot manipulator with unknown uncertainties and disturbances. It presents a new control method that uses only joint position measurements to design a tracking controller. The controller has two parts. One is based on a feedback linearization technique; it makes the nominal model of a manipulator asymptotically track a desired trajectory. The other is based on the idea of equivalent input disturbance (EID); it compensates for uncertainties and disturbances. Together they enable a robot manipulator to precisely track the desired trajectory. The new control algorithm is applied to a two-link robot manipulator, and simulation results demonstrate the validity of this method.

1. Introduction

Robot manipulators are widely used in many fields. They are especially useful in areas where it is impractical or undesirable for a human to go, for example, undersea exploration, radioactive environments, and defusing explosive devices. Interest in the control of robot manipulators has been increasing over the past few years [1–3], and it is now a central issue in robotics.

If an exact dynamic model of a robot manipulator is known, the motion control problem is easy to solve by the computed-torque-control (CTC) method [4]. It uses nonlinear state feedback to cancel the nonlinear terms and a simple PD controller for motion control. Although this method is simple and effective, the requirement of an exact model limits its practicality because it is usually impossible to obtain an exact, or even reasonably accurate, dynamic model in practical applications. For example, an actual plant inevitably contains structured and unstructured uncertainties, and a robot manipulator may be influenced by unpredictable external disturbances when the operating environment changes. Since these uncertainties and disturbances may greatly affect

control performance, it is necessary to consider their effects in the study of the motion control of robot manipulators.

A number of strategies have been developed to solve the problem of controlling the motion of a robot manipulator with uncertainties and disturbances. They include a Lyapunov-based method [5], a neural-network-based method [6, 7], an adaptive neural network H_∞ strategy [8], an adaptive switching learning PD (ASL-PD) method [9], a parameter-dependent nonlinear observer approach [10], and a variable-structure PID control method [11]. However, all of them require measurement of both the displacement and velocity of joints.

Generally speaking, joint displacement can be accurately measured with an encoder. However, velocity is typically measured with a tachometer, and the results usually contain noise, which can affect the control precision and performance of a closed-loop system. So, both practically and theoretically, it is meaningful to devise a motion control method for robot manipulators which relies only on the measurement of joint position. Various strategies have been developed to solve this challenging problem. One is a controller-observer combination strategy. It has a two-step design procedure:

Robust Tracking Control Of Robot Manipulators

Ensheng Dong



Robust Tracking Control Of Robot Manipulators:

Immerse yourself in heartwarming tales of love and emotion with Explore Love with is touching creation, Experience Loveis Journey in **Robust Tracking Control Of Robot Manipulators** . This emotionally charged ebook, available for download in a PDF format (PDF Size: *), is a celebration of love in all its forms. Download now and let the warmth of these stories envelop your heart.

https://pinsupreme.com/About/browse/Download_PDFS/Saturday%20Eveng%20Post%20Time%20To%20En.pdf

Table of Contents Robust Tracking Control Of Robot Manipulators

1. Understanding the eBook Robust Tracking Control Of Robot Manipulators
 - The Rise of Digital Reading Robust Tracking Control Of Robot Manipulators
 - Advantages of eBooks Over Traditional Books
2. Identifying Robust Tracking Control Of Robot Manipulators
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Robust Tracking Control Of Robot Manipulators
 - User-Friendly Interface
4. Exploring eBook Recommendations from Robust Tracking Control Of Robot Manipulators
 - Personalized Recommendations
 - Robust Tracking Control Of Robot Manipulators User Reviews and Ratings
 - Robust Tracking Control Of Robot Manipulators and Bestseller Lists
5. Accessing Robust Tracking Control Of Robot Manipulators Free and Paid eBooks
 - Robust Tracking Control Of Robot Manipulators Public Domain eBooks
 - Robust Tracking Control Of Robot Manipulators eBook Subscription Services
 - Robust Tracking Control Of Robot Manipulators Budget-Friendly Options

6. Navigating Robust Tracking Control Of Robot Manipulators eBook Formats
 - ePub, PDF, MOBI, and More
 - Robust Tracking Control Of Robot Manipulators Compatibility with Devices
 - Robust Tracking Control Of Robot Manipulators Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Robust Tracking Control Of Robot Manipulators
 - Highlighting and Note-Taking Robust Tracking Control Of Robot Manipulators
 - Interactive Elements Robust Tracking Control Of Robot Manipulators
8. Staying Engaged with Robust Tracking Control Of Robot Manipulators
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Robust Tracking Control Of Robot Manipulators
9. Balancing eBooks and Physical Books Robust Tracking Control Of Robot Manipulators
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Robust Tracking Control Of Robot Manipulators
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Robust Tracking Control Of Robot Manipulators
 - Setting Reading Goals Robust Tracking Control Of Robot Manipulators
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Robust Tracking Control Of Robot Manipulators
 - Fact-Checking eBook Content of Robust Tracking Control Of Robot Manipulators
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements

- Interactive and Gamified eBooks

Robust Tracking Control Of Robot Manipulators Introduction

In this digital age, the convenience of accessing information at our fingertips has become a necessity. Whether its research papers, eBooks, or user manuals, PDF files have become the preferred format for sharing and reading documents. However, the cost associated with purchasing PDF files can sometimes be a barrier for many individuals and organizations. Thankfully, there are numerous websites and platforms that allow users to download free PDF files legally. In this article, we will explore some of the best platforms to download free PDFs. One of the most popular platforms to download free PDF files is Project Gutenberg. This online library offers over 60,000 free eBooks that are in the public domain. From classic literature to historical documents, Project Gutenberg provides a wide range of PDF files that can be downloaded and enjoyed on various devices. The website is user-friendly and allows users to search for specific titles or browse through different categories. Another reliable platform for downloading Robust Tracking Control Of Robot Manipulators free PDF files is Open Library. With its vast collection of over 1 million eBooks, Open Library has something for every reader. The website offers a seamless experience by providing options to borrow or download PDF files. Users simply need to create a free account to access this treasure trove of knowledge. Open Library also allows users to contribute by uploading and sharing their own PDF files, making it a collaborative platform for book enthusiasts. For those interested in academic resources, there are websites dedicated to providing free PDFs of research papers and scientific articles. One such website is Academia.edu, which allows researchers and scholars to share their work with a global audience. Users can download PDF files of research papers, theses, and dissertations covering a wide range of subjects. Academia.edu also provides a platform for discussions and networking within the academic community. When it comes to downloading Robust Tracking Control Of Robot Manipulators free PDF files of magazines, brochures, and catalogs, Issuu is a popular choice. This digital publishing platform hosts a vast collection of publications from around the world. Users can search for specific titles or explore various categories and genres. Issuu offers a seamless reading experience with its user-friendly interface and allows users to download PDF files for offline reading. Apart from dedicated platforms, search engines also play a crucial role in finding free PDF files. Google, for instance, has an advanced search feature that allows users to filter results by file type. By specifying the file type as "PDF," users can find websites that offer free PDF downloads on a specific topic. While downloading Robust Tracking Control Of Robot Manipulators free PDF files is convenient, its important to note that copyright laws must be respected. Always ensure that the PDF files you download are legally available for free. Many authors and publishers voluntarily provide free PDF versions of their work, but its essential to be cautious and verify the authenticity of the source before downloading Robust Tracking Control Of Robot Manipulators. In conclusion, the internet offers numerous platforms and websites that allow users

to download free PDF files legally. Whether its classic literature, research papers, or magazines, there is something for everyone. The platforms mentioned in this article, such as Project Gutenberg, Open Library, Academia.edu, and Issuu, provide access to a vast collection of PDF files. However, users should always be cautious and verify the legality of the source before downloading Robust Tracking Control Of Robot Manipulators any PDF files. With these platforms, the world of PDF downloads is just a click away.

FAQs About Robust Tracking Control Of Robot Manipulators Books

How do I know which eBook platform is the best for me? Finding the best eBook platform depends on your reading preferences and device compatibility. Research different platforms, read user reviews, and explore their features before making a choice. Are free eBooks of good quality? Yes, many reputable platforms offer high-quality free eBooks, including classics and public domain works. However, make sure to verify the source to ensure the eBook credibility. Can I read eBooks without an eReader? Absolutely! Most eBook platforms offer web-based readers or mobile apps that allow you to read eBooks on your computer, tablet, or smartphone. How do I avoid digital eye strain while reading eBooks? To prevent digital eye strain, take regular breaks, adjust the font size and background color, and ensure proper lighting while reading eBooks. What the advantage of interactive eBooks? Interactive eBooks incorporate multimedia elements, quizzes, and activities, enhancing the reader engagement and providing a more immersive learning experience. Robust Tracking Control Of Robot Manipulators is one of the best book in our library for free trial. We provide copy of Robust Tracking Control Of Robot Manipulators in digital format, so the resources that you find are reliable. There are also many Ebooks of related with Robust Tracking Control Of Robot Manipulators. Where to download Robust Tracking Control Of Robot Manipulators online for free? Are you looking for Robust Tracking Control Of Robot Manipulators PDF? This is definitely going to save you time and cash in something you should think about.

Find Robust Tracking Control Of Robot Manipulators :

saturday eveng post time to en

satisfied mind the country music life of porter wagoner

saving monticello the levy familys epic

sathya sai baba the embodiment of love

savor montana cookbook ii savor cookbooks

~~saturday is cookouts from kebabs and ribs to potato salad and more~~

~~sastre de panama~~

~~santas christmas~~

~~satans coast~~

say hello to the hit man.

~~sarah thorndike press large print christian fiction~~

~~saving the river the story of the st croix river~~

~~santas stuck~~

satirae cum commentariis caroli fri 2vol

~~sas guide to the report procedure usage and reference version 6~~

Robust Tracking Control Of Robot Manipulators :

henry s clinical diagnosis and management by laboratory - Jul 13 2023

web henry s clinical diagnosis and management by laboratory methods 22nd edition free pdf download 1 508 pages year 2011 matthew henry

henry s clinical diagnosis and management by - Feb 25 2022

web henry clinical diagnosis and laboratory 22nd edition is available in our book collection an online access to it is set as public so you can get it instantly our digital library saves

henry s clinical diagnosis and management by lab - Feb 08 2023

web henry s clinical diagnosis and management by laboratory methods 22 e editor richard a mcpherson publisher elsevier india 2016 isbn 8131231275

download henry s clinical diagnosis and management by - Jan 27 2022

web henry s clinical diagnosis and management by laboratory methods 24th edition for more than 100 years henry s clinical diagnosis and management by laboratory

henry s clinical diagnosis and management by - Jun 12 2023

web for more than 100 years henry s clinical diagnosis and management by laboratory methods has been recognized as the premier text in clinical laboratory medicine

henry s clinical diagnosis and management by laboratory - Dec 06 2022

web henry s clinical diagnosis and management by laboratory methods authors richard a mcpherson editor matthew r pincus editor summary recognized as the definitive

[henrys clinical diagnosis and management by laboratory](#) - Aug 14 2023

web dec 5 2021 henrys clinical diagnosis and management by laboratory methods 22nd edition by richard a mcpherson md matthew r pincus md phd addeddate 2021 12

henry s clinical diagnosis and management by laboratory methods - Oct 04 2022

web jan 1 2011 henry s clinical diagnosis and management by laboratory methods 22 edition pincus mcpherson pincus mcpherson pincus mcpherson

henry s clinical diagnosis and management by laboratory - May 31 2022

web download henry s clinical diagnosis and management by laboratory methods 22nd edition chm type chm size 46mb download as pdf download original pdf this

henry s clinical diagnosis and management by laboratory - Sep 03 2022

web mar 7 2021 we provide this henry s clinical diagnosis and management by laboratory methods 22e 22nd edition by mcpherson md richard a pincus md phd matthew r

elsevier henry s clinical diagnosis and management by - Nov 05 2022

web apr 5 2017 elsevier health sciences apr 5 2017 medical 1700 pages recognized as the definitive reference in laboratory medicine since 1908 henry s clinical diagnosis

henry clinical diagnosis and laboratory 22nd edition 2022 - Oct 24 2021

henry s clinical diagnosis and management by - Apr 29 2022

web henry s clinical diagnosis and management by laboratory methods this title has been archived publisher elsevier health sciences publication date 2017 isbn 10

[henry s clinical diagnosis and management by laboratory methods](#) - Dec 26 2021

web buy henry s clinical diagnosis and management by laboratory methods first south asia edition online on amazon eg at best prices fast and free shipping free returns

henry s clinical diagnosis and management by laboratory pdf - Jul 01 2022

web aug 18 2006 henry s clinical diagnosis and management by laboratory methods 22nd edition expert consult online and print inproceedings pincus2006henryscd

[chapter 3 henry clinical diagnosis and management by lab](#) - Nov 24 2021

[henry s clinical diagnosis and management by laboratory](#) - Sep 22 2021

henry s clinical diagnosis and management by laboratory - Mar 29 2022

web chapter 3 henry clinical diagnosis and management by lab methods free download as pdf file pdf text file txt or read online for free patklin patklin 1994 flow med

henry s clinical diagnosis and management by laboratory methods - Mar 09 2023

web sep 6 2011 update your understanding of the scientific foundation and clinical application of today s complete range of laboratory tests get optimal test results with guidance on

henry s clinical diagnosis and management by laboratory - Aug 02 2022

web e book overview recognized as the definitive book in laboratory medicine since 1908 henry s clinical diagnosis and management by laboratory methods edited by

henry s clinical diagnosis and management by lab - May 11 2023

web jun 1 2021 offer details description for more than 100 years henry s clinical diagnosis and management by laboratory methods has been recognized as the

henry s clinical diagnosis and management by laboratory - Aug 22 2021

henry s clinical diagnosis and management by laboratory - Jan 07 2023

web feb 21 2007 description recognized as the definitive reference in laboratory medicine since 1908 henry s clinical diagnosis continues to offer state of the art guidance on

henry s clinical diagnosis and management by laboratory methods - Apr 10 2023

web jun 9 2021 elsevier health sciences jun 9 2021 medical 1618 pages for more than 100 years henry s clinical diagnosis and management by laboratory methods has

can man live without god ravi zacharias - May 29 2023

web aug 30 2004 can man live without god ravi zacharias thomas nelson aug 30 2004 religion 240 pages in this brilliant and compelling defense of the christian faith

ravi zacharias can man live without god mere pensees - Aug 20 2022

web can man live without god book by ravi zacharias earn 2x points on select legal thrillers includes grisham patterson and more religion spirituality books

can man live without god amazon com - Sep 01 2023

web can man live without god zacharias ravi k free download borrow and streaming internet archive by zacharias ravi k publication date 1994 topics jesus christ

can man live without god dr ravi zacharias ravi zacharias - May 17 2022

web eleanor roosevelt collection of sourced quotations from can man live without god 1994 by ravi zacharias share with your friends the best quotes from can man live without

[can man live without god ravi zacharias google books](#) - Apr 27 2023

web jan 1 1994 when former skeptic and seventeen year old ravi zacharias heard the words of jesus in john 14 19 because i live you also will live the trajectory of his life

can man live without god zacharias ravi amazon com - Dec 12 2021

can man live without god quotes ravi zacharias lib quotes - Apr 15 2022

web can man live without god zacharias ravi k free download borrow and streaming internet archive by zacharias ravi k publication date 1994 topics jesus christ

[can man live without god by ravi zacharias](#) - Oct 02 2023

web aug 30 2004 in can man live without god dr ravi zacharias explores what he calls the greatest question of our time can man live without god it is written for those

book review can man live without god jaydinitto com - Jun 17 2022

web oct 17 2021 5 79k subscribers subscribe 21 473 views 1 year ago canmanlovewithoutgod ravizacharias ravizachariasinterview i hold the view that all

can man live without god amazon co uk zacharias ravi k - Feb 11 2022

web rate this book ratings

can man live without god by ravi zacharias book reviews - Jan 13 2022

web jan 1 1994 ravi zacharias i promise i will leave no stone unturned in my pursuit of truth when former skeptic and seventeen year old ravi zacharias heard the words of

can man live without god ravi zacharias google books - Feb 23 2023

web sep 1 2004 when former skeptic and seventeen year old ravi zacharias heard the words of jesus in john 14 19 because i live you also will live the trajectory of his life

can man live without god zacharias ravi k amazon com - Mar 27 2023

web jul 21 1996 can man live without god in this brilliant and compelling defense of the christian faith ravi zacharias shows how affirming the reality of god s existence

can man live without god book by ravi zacharias thriftbooks - Jul 19 2022

web sep 18 2012 ravi zacharias can man live without god explores the moral and material not spiritual consequences of atheism particularly on a cultural scale i think

can a man live without god zacharias preach it teach it - Nov 22 2022

web in this brilliant and compelling defense of the christian faith ravi zacharias shows how affirming the reality of god s existence matters urgently in our everyday lives according

can man live without god by ravi zacharias librarything - Oct 22 2022

web may 16 2015 can man live without god kindle edition is a treatment by ravi zacharias of the philosophical issue of meaning and the psychological issue of despair

ravi zacharias can man live without god youtube - Dec 24 2022

web ravi zacharias can a man live without god ravi zacharias john ankerberg welcome to our program i m john ankerberg i m glad that you joined us

can man live without god zacharias ravi k free download - Jul 31 2023

web can man live without god by ravi zacharias 2 580 ratings 4 30 average rating 119 reviews can man live without god quotes showing 1 15 of 15 i am absolutely

can man live without god amazon co uk zacharias ravi k - Jan 25 2023

web aug 21 2012 0 00 1 10 09 ravi zacharias can man live without god jasonofthel33t 10k subscribers subscribe 1 7k share save 149k views 10 years ago i m simply re

can man live without god quotes by ravi zacharias goodreads - Jun 29 2023

web in can man live without god dr ravi zacharias explores what he calls the greatest question of our time can man live without god it is written for those who are

can man live without god zacharias ravi k free download - Mar 15 2022

web may 16 2017 4 7 out of 5 stars see all formats and editions audio cd abridged audiobook paperback 0 93 11 used from 0 93 1 new from audio cd from 16 30 1

book review can man live without god by ravi zacharias - Sep 20 2022

web nov 7 2019 mere pensees ravi zacharias can man live without god november 7 2019 by roger clegg ravi zacharias is one of today s leading christian apologists

thank you god a jewish child s book of prayers - Aug 14 2023

web jan 1 2003 thank you god a jewish child s book of prayers english and hebrew edition wikler madeline groner judyth haas shelly o on amazon com free

thank you god a jewish child s book of prayers sh - Nov 24 2021

web discover and share books you love on goodreads

pregnant awaitng mothers programme 12th - Sep 22 2021

web jan 1 1993 thank you god a jewish child s book of prayers madeline wikler madeline wikler judyth groner 4 31 61 ratings4 reviews a first prayer book for young

thank you god a jewish child s book of paperback - Dec 06 2022

web jan 1 2014 a first prayer book for young children with 21 traditional prayers in simple hebrew transliteration and english contains blessings for a new day bounty of our

thank you god a jewish child s book of prayers - Jan 07 2023

web thank you god a jewish child s book of wikler madeline groner judyth haas shelly o 9781580131018 books amazon ca

thank you god a jewish child s book of prayers google books - Apr 10 2023

web a first prayer book for young children with 21 traditional prayers in simple hebrew transliteration and english contains blessings for a new day bounty of our food

thank you god a jewish child s book of prayers scribd - Nov 05 2022

web abebooks com thank you god a jewish child s book of prayers english hebrew and hebrew edition 9780929371658 by groner judyth wikler madeline haas

pdf thank you god a jewish child s book of prayers sh - Aug 02 2022

web find helpful customer reviews and review ratings for thank you god a jewish child s book of prayers english and hebrew edition at amazon com read honest and

thank you god a jewish child s book of prayers sh pdf - Apr 29 2022

web jul 21 2023 may 6th 2020 abebooks thank you god a jewish child s book of prayers english and hebrew edition 9781580131018 by groner judyth wikler madeline and a great

thank you god a jewish child s book of prayers goodreads - Jun 12 2023

web jan 1 1993 a first prayer book for young children with 21 traditional jewish prayers in simple hebrew english translation and transliteration blessings for a new day the

thank you god a jewish child s book of prayers goodreads - Aug 22 2021

thank you god a jewish child s book of prayers shabbat - Jul 13 2023

web buy thank you god a jewish child s book of prayers shabbat illustrated by groner judyth wikler madeline isbn 9781580131018 from amazon s book store everyday

thank you god a jewish child s book of prayers google books - Feb 08 2023

web thank you god a jewish child s book of prayers authors judyth saypol groner madeline wikler shelly o haas summary presents common jewish prayers and

thank you god a jewish child s book of prayers - Mar 09 2023

web a first prayer book for young children with 21 traditional jewish prayers in simple hebrew english translation and transliteration blessings for a new day the bounty of

[thank you god a jewish child s book of prayers english](#) - Oct 04 2022

web jan 1 2014 this beautiful first prayer book for young children features 21 traditional jewish prayers in simple hebrew with english translation and transliteration related

amazon com customer reviews thank you god a jewish - Jul 01 2022

web find helpful customer reviews and review ratings for thank you god a jewish child s book of prayers english hebrew and hebrew edition at amazon com read honest

thank you god a jewish child s book of prayers sh 2022 - Dec 26 2021

web feb 4 2023 thank you god a jewish child s book of prayers sh is available in our book collection an online access to it is set as public so you can download it instantly

thank you god a jewish child s book of prayers ebook - Sep 03 2022

web thank you god a jewish child s book of prayers sh the witness of the jews to god dec 01 2020 this book while presenting the contribution of a variety of scholars also

loading interface goodreads - Oct 24 2021

web pregnant awaitng mothers programme 12th september 2023 stay connected and be blessed

zionprayermovementoutreach zpmom

thank you god a jewish child s book of prayers shabbat by - Mar 29 2022

web aug 2 2023 thank you god a jewish child s book of prayers sh is available in our book collection an online access to it is set as public so you can download it instantly our

amazon com customer reviews thank you god a jewish - May 31 2022

web aug 18 2023 online pronouncement thank you god a jewish child s book of prayers sh can be one of the options to accompany you taking into consideration having extra time

thank you god a jewish child s book of prayers sh pdf - Feb 25 2022

web mar 18 2023 thank you god a jewish child s book of prayers sh 3 8 downloaded from uniport edu ng on march 18 2023 by guest the jewish herald and record of christian

thank you god a jewish child s book of prayers sh pdf - Jan 27 2022

web thank you god a jewish child s book of prayers sh 1 thank you god a jewish child s book of prayers sh thank you god a jewish childs book of prayers

thank you god a jewish child s book of prayers kar ben - May 11 2023

web a first prayer book for young children with 21 traditional prayers in simple hebrew transliteration and english contains blessings for a new day bounty of our food