Robotics Aerial Robotics Coursera

Bio-inspired Flying Robots
Methods for Online Predictive Control of Multi-rotor Aerial Robots with Perception-driven Tasks Subject to Sensing and Actuation Constraints
Smart Autonomous Aircraft
Modeling and Control of a Class of Aerial Robotic Systems
Design, Modeling and Control of Aerial Robots for Physical Interaction and Manipulation
Lighter than Air Robots
Control of Ground and Aerial Robots
Aerial Robots
Nonlinear Dynamics and Control of Aerial Robots
Aerial Manipulation
Developing Reactive Distributed Aerial Robotics Platforms for Real-time Contaminant Mapping
Multi-UAV Planning and Task Allocation
Planning and Decision Making for Aerial Robots
Toward Tactical Autonomy in Aerial Robotics
Theory and Applications for Control of Aerial Robots in Physical Interaction Through Tethers
Aerial Robotic Workers
The Development of an Aerial Robotics Laboratory Highlighting the First Experimental Validation of Optimal Reciprocal Collision Avoidance
A First Course in Aerial Robots and Drones
Inclusive Robotics for a Better Society
Planning and Decision Making for Aerial Robots
Autonomous Robots
Modeling, Control, State Estimation and Path Planning Methods for Autonomous Multirotor Aerial Robots
Aerial Robotics for Inspection and Maintenance
Aerial Robotics

Special Issue on Aerial Robotics
Load Transportation Using Aerial Robots
Aerial Robots - Aerodynamics, Control and Applications
Intelligent Autonomy of UAVs
Autonomous Flying Robots
Enabling Large-scale Collective Systems in Outdoor Aerial Robotics
Control and Signal Processing Applications for Mobile and Aerial Robotic Systems
Aerial Robotic Manipulation
Modern Robotics
Intelligent Autonomy of Uavs
The Flying Machine Arena
For Inspiration and Recognition of Science and Technology
Models, Algorithms and Architectures for Cooperative Manipulation with Aerial and Ground Robots
Planning and Decision Making for Aerial Robots
Flying Insects and Robots
Dynamics and Control of Autonomous Space Vehicles and Robotics

JOSIAH CYNTHIA

Bio-inspired Flying Robots IGI Global, Engineering Science Reference
Presents the established principles underpinning space robotics with a thorough and modern approach. This text is perfect for professionals in the field looking to gain an understanding of real-life applications of manipulators on satellites, and of the dynamics of satellites carrying robotic manipulators and of planetary rovers.
Methods for Online Predictive Control of Multi-rotor Aerial Robots with Perception-driven Tasks Subject to Sensing and Actuation Constraints Springer Science & Business Media
Flying insects are intelligent micromachines capable of exquisite maneuvers in unpredictable environments. Understanding these systems advances our knowledge of flight control, sensor suites, and unsteady aerodynamics, which is of crucial interest to engineers developing intelligent flying robots or micro air vehicles (MAVs). The insights we gain when synthesizing bioinspired systems can in turn benefit the fields of neurophysiology, ethology and zoology by providing real-life tests of the proposed models. This book was written by biologists and engineers leading the research in this crossdisciplinary field. It

examines all aspects of the mechanics, technology and intelligence of insects and insectoids. After introductory-level overviews of flight control in insects, dedicated chapters focus on the development of autonomous flying systems using biological principles to sense their surroundings and autonomously navigate. A significant part of the book is dedicated to the mechanics and control of flapping wings both in insects and artificial systems. Finally hybrid locomotion, energy harvesting and manufacturing of small flying robots are covered. A particular feature of the book is the depth on realization topics such as control engineering, electronics, mechanics, optics, robotics and manufacturing. This book will be of interest to academic and industrial researchers engaged with theory and engineering in the domains of aerial robotics, artificial intelligence, and entomology.

Smart Autonomous Aircraft BoD – Books on Demand

An aerial robot is a system capable of sustained flight with no direct human control and able to perform a specific task. A lighter than air robot is an aerial robot that relies on the static lift to balance its own weight. It can also be defined as a lighter than air unmanned aerial vehicle or an unmanned airship with sufficient autonomy. Lighter than air systems are particularly appealing since the energy to keep them airborne is small. They are increasingly considered for various tasks such as monitoring, surveillance, advertising, freight carrier, transportation. This book familiarizes readers with a hierarchical decoupled planning and control strategy that has been proven efficient through research. It is made up of a hierarchy of modules with well defined functions operating at a variety of rates, linked together from top to bottom. The outer loop, closed periodically, consists of a discrete search that produces a set of waypoints leading to the goal while avoiding obstacles and weighed regions. The second level smoothes this set so that the generated paths are feasible given the vehicle's velocity and accelerations limits. The third level generates flyable, timed trajectories and the last one is the tracking controller that attempts to minimize the error between the robot measured trajectory and the reference trajectory. This hierarchy is reflected in the structure and content of the book. Topics treated are: Modelling, Flight Planning, Trajectory Design and Control. Finally, some actual projects are described in the appendix. This volume will prove useful for researchers and practitioners working in Robotics and Automation, Aerospace Technology, Control and Artificial Intelligence.

Modeling and Control of a Class of Aerial Robotic Systems Butterworth-Heinemann

A modern and unified treatment of the mechanics, planning, and control of robots, suitable for a first course in robotics.

Design, Modeling and Control of Aerial Robots for Physical Interaction and Manipulation Springer

Aerial robots with perception, navigation, and manipulation capabilities are extending the range of applications of drones, allowing the integration of different sensor devices and robotic manipulators to perform inspection and maintenance operations on infrastructures such as power lines, bridges, viaducts, or

walls, involving typically physical interactions on flight. New research and technological challenges arise from applications demanding the benefits of aerial robots, particularly in outdoor environments. This book collects eleven papers from different research groups from Spain, Croatia, Italy, Japan, the USA, the Netherlands, and Denmark, focused on the design, development, and experimental validation of methods and technologies for inspection and maintenance using aerial robots.
Lighter than Air Robots Springer Nature
This text is a thorough treatment of the rapidly growing area of aerial manipulation. It details all the design steps required for the modeling and control of unmanned aerial vehicles (UAV) equipped with robotic manipulators. Starting with the physical basics of rigid-body kinematics, the book gives an in-depth presentation of local and global coordinates, together with the representation of orientation and motion in fixed- and moving-coordinate systems. Coverage of the kinematics and dynamics of unmanned aerial vehicles is developed in a succession of popular UAV configurations for multirotor systems. Such an arrangement, supported by frequent examples and end-of-chapter exercises, leads the reader from simple to more complex UAV configurations. Propulsion-system aerodynamics, essential in UAV design, is analyzed through blade-element and momentum theories, analysis which is followed by a description of drag and ground-aerodynamic effects. The central part of the book is dedicated to aerial-manipulator kinematics, dynamics, and control. Based on foundations laid in the opening chapters, this portion of the book is a structured presentation of Newton–Euler dynamic modeling that results in forward and backward equations in both fixed- and moving-coordinate systems. The Lagrange–Euler approach is applied to expand the model further, providing formalisms to model the variable moment of inertia later used to analyze the dynamics of aerial manipulators in contact with the environment. Using knowledge from sensor data, insights are presented into the ways in which linear, robust, and adaptive control techniques can be applied in aerial manipulation so as to tackle the real-world problems faced by scholars and engineers in the design and implementation of aerial robotics systems. The book is completed by path and trajectory planning with vision-based examples for tracking and manipulation.
Control of Ground and Aerial Robots
Cambridge University Press
Please note that the content of this book primarily consists of articles available from Wikipedia or other free sources online. Pages: 27. Chapters: Collegiate Aerial Robotics Demonstration, Dave Lavery, Dean Kamen, FIRST Championship, FIRST Lego League, FIRST Lego League Open Championships, FIRST Robotics Competition, FIRST Tech Challenge, Junior FIRST Lego League, Livingston Robotics Club, Mark Leon, The New Cool (book), Woodie Flowers. Excerpt: The FIRST Robotics Competition is an international high school robotics competition organized by FIRST (For Inspiration and Recognition of Science and Technology). Each year, teams of high school students compete to build robots weighing up to 120 pounds (54 kg), not including battery and bumpers, that can complete a task, which changes every year. While teams are given a standard set of parts, they are also

allowed a budget and encouraged to buy or make specialized parts as long as they conform to FIRST safety rules. Game details are revealed at the beginning of January and the teams are given six weeks to construct a competitive robot, that can operate autonomously as well as when guided by wireless controls, to accomplish the game's tasks. In 2010, the 19th year of competition, 1,808 high school teams with roughly 45,000 students from Australia, Brazil, Canada, Turkey, the Netherlands, Israel, the United States, the United Kingdom, and Mexico were involved. In 2011, 2,075 teams participated in competitions in the United States, Canada, and Israel. 1992: Maize CrazeFIRST was founded in 1989 by inventor and entrepreneur Dean Kamen, with inspiration and assistance from physicist and MIT professor emeritus Woodie Flowers. Kamen has stated that FIRST is the invention he feels most proud of for creating, and predicts that participants who have taken part in its contests so far will be responsible for some significant technological advances in years to come. The first FRC season was in 1992 and had only one event at a...

Aerial Robots CRC Press
Few years ago, the topic of aerial robots was exclusively related to the robotics community, so a great number of books about the dynamics and control of aerial robots and UAVs have been written. As the control technology for UAVs advances, the great interaction that exists between other systems and elements that are as important as control such as aerodynamics, energy efficiency, acoustics, structural integrity, and applications, among others has become evident. Aerial Robots - Aerodynamics, Control, and Applications is an attempt to bring some of these topics related to UAVs together in just one book and to look at a selection of the most relevant problems of UAVs in a broader engineering perspective.

Nonlinear Dynamics and Control of Aerial Robots CRC Press
A First Course in Aerial Robots and Drones provides an accessible and student friendly introduction to aerial robots and drones. Drones figure prominently as opportunities for students to learn various aspects of aerospace engineering and design. Drones offer an enticing entry point for STEM studies. As the use of drones in STEM studies grows, there is an emerging generation of drone pilots who are not just good at flying, but experts in specific niches, such as mapping or thermography. Key Features: Focuses on algorithms that are currently used to solve diverse problems. Enables students to solve problems and improve their science skills. Introduces difficult concepts with simple, accessible examples. Suitable for undergraduate students, this textbook provides students and other readers with methods for solving problems and improving their science skills.

Aerial Manipulation Springer Science & Business Media
Unmanned aerial vehicles are increasingly being used to perform complex functions or to assist humans to carry out dangerous missions within dynamic environments. Other possible applications include search and rescue, disaster relief operations, environmental monitoring, wireless surveillance networks, and cooperative manipulation. Creating these types of autonomous aerial vehicles places severe demands on the design of control schemes that can adapt to different scenarios and

possible changes of vehicle dynamics. In this book we address the challenging problem of employing aerial robots to transport and manipulate loads safely and efficiently. Aerial load manipulation and transportation is extremely important in emergency rescue missions as well as for military and industrial purposes. This book gives an insight into problems that can arise in aerial load transportation and suggests control systems techniques to solve them. A key focus is given on modeling of the aerial load transportation system as well as stability and robustness analysis. A detailed design and derivation of control algorithms based on adaptive control, optimal control and reinforcement learning are discussed in detail. Furthermore, an experimental testbed and controller implementation are delineated.

Developing Reactive Distributed Aerial Robotics Platforms for Real-time Contaminant Mapping Springer Nature

This book studies how autonomous aerial robots physically interact with the surrounding environment. Intended to promote the advancement of aerial physical interaction, it analyzes a particular class of aerial robots: tethered aerial vehicles. By examining specific systems, while still considering the challenges of the general problem, it will help readers acquire the knowledge and expertise needed for the subsequent development of more general methods applicable to aerial physical interaction. The formal analysis covers topics ranging from control, state estimation, and motion planning, to experimental validation. Addressing both theoretical and technical aspects, the book is intended for a broad academic and industrial readership, including undergraduate students, researchers and engineers. It can be used as a teaching reference, or as the basis for product development.

Multi-UAV Planning and Task Allocation Springer

Smart Autonomous Aircraft: Flight Control and Planning for UAV introduces the advanced methods of flight control, planning, situation awareness, and decision making. This book is among the first to emphasize the theoretic and algorithmic side of control and planning in dynamic and uncertain environments. Focused on the latest th

Planning and Decision Making for Aerial Robots Springer

Drones have an increasing place in numerous applications already started to take advantage from those, in particular in the fields of photography and video making, or simply for leisure activities. Simultaneously, the picture of autonomous aerial robots widely spread as a mark of innovation, such that many civilian of industrial applications are now envisioned through this aspect. One could cite, for instance, the persistent idea of aerial home delivery of goods, exploited by many companies. Another spread use-case is the deployment of fleets of aerial robots for monitoring activities, in hard-to-access environments, such as high mountains.The aerial robotics research community is active from numerous years, and the state of the art keeps improving, being through the conception of novel, more adaptive control algorithms, or the improvements of the hardware designs, opening new ranges of possibilities.The deployment of such robots in the scope of applications in uncontrolled environments comes with a lot of challenges, in particular regarding the perception of the surroundings. Exteroceptive sensors are indeed mandatory for most of autonomous applications. Among those sensors, cameras hold a peculiar position.It is on the one hand due to the simple onboard integration with their small size and weight,and on the other hand to the design of human-made environments, which are heavily built around visual markers (signs, illuminated signals...) However, maintaining visibility over objects or phenomenon often collide with the motion requirements of the robot, or with the tasks to which it is assigned. This effect is prominent when using underactuated robots, which are the most widely spread types of aerial vehicles, partly because of their higher energy efficiency. This property implies a strong coupling between position and orientation: the robot needs to tilt to move, and corollary moves when it tilts, thus altering the sensor bearing.From this assessment, the robotics community works to produce sensorimotor algorithms, able to produce motions while accounting for perception.This thesis takes place in this context, aiming at proposing such control methods to enforce the visibility over a phenomenon of interest through the onboard sensors. Moreover, to ensure the feasibility of the generated commands, it is required to account for the various actuation limitations of the robots. Finally, this thesis devotes to propose generic formulations, thus avoiding to propose ad hoc solutions, which would be contingent to a specific problem.To tackles these aspects under a common formalism, the proposed solutions are based on optimal and predictive control policies. These are based on numerical optimization, implying the need of accurate models, and thus accounting for the system nonlinearities, which are often disregarded for simplification.The contributions of this these are the aggregation of the various concepts in a common paradigm,and the formalization of the various mathematical functions transcribing the objectives and constraints related to perception. This paradigm is used in the scope of several applications related to usual perception-driven tasks in aerial robotics, namely the tracking of dynamic phenomenon, the improvement of this tracking, or the visual-inertial localization. Finally, the proposed solutions are implemented and tested in simulations and on real aerial robots.The work conducted throughout this thesis led to various publications in international peer-reviewed conferences and journals. All the related software production from these works are published open-source for the robotics community.

Toward Tactical Autonomy in Aerial Robotics Foundations and Trends (R) in Robotics

The advance in robotics has boosted the application of autonomous vehicles to perform tedious and risky tasks or to be cost-effective substitutes for their - man counterparts. Based on their working environment, a rough classi cation of the autonomous vehicles would include unmanned aerial vehicles (UAVs), - manned ground vehicles (UGVs), autonomous underwater vehicles (AUVs), and autonomous surface vehicles (ASVs). UAVs, UGVs, AUVs, and ASVs are called UVs (unmanned vehicles) nowadays. In recent decades, the development of - manned autonomous vehicles have been of great interest, and different kinds of autonomous vehicles have been studied and developed all over the world. In part- ular, UAVs have many applications in emergency situations; humans often cannot come close to a dangerous natural disaster such as an earthquake, a ood, an active volcano, or a nuclear disaster. Since the development of the rst UAVs, research efforts have been focused on military applications. Recently, however, demand has arisen for UAVs such as aero-robotsand ying robotsthat can be used in emergency situations and in industrial applications. Among the wide variety of UAVs that have been developed, small-scale HUAVs (helicopter-based UAVs) have the ability to take off and land vertically as well as the ability to cruise in ight, but their most importantcapability is hovering. Hoveringat a point enables us to make more eff- tive observations of a target. Furthermore, small-scale HUAVs offer the advantages of low cost and easy operation.

Theory and Applications for Control of Aerial Robots in Physical Interaction Through Tethers Createspace Independent Publishing Platform

In recent years, the subject of physical interaction for aerial robots has been a popular research area with many new mechanical designs and control approaches being proposed. The aerial robotics community is currently observing a paradigm shift from classic guidance, navigation, and control tasks towards more unusual tasks, for example requesting aerial robots to physically interact with the environment, thus extending the manipulation task from the ground into the air. This thesis contributes to the field of aerial manipulation by proposing a novel concept known has Multiple Aerial-Ground Manipulator System or MAGMaS, including what appears to be the first experimental demonstration of a MAGMaS and opening a new route of research. The motivation behind associating ground and aerial robots for cooperative manipulation is to leverage their respective particularities, ground robots bring strength while aerial robots widen the workspace of the system. The first contribution of this work introduces a meticulous system model for MAGMaS. The system model's properties and potential extensions are discussed in this work. The planning, estimation and control methods which are necessary to exploit MAGMaS in a cooperative manipulation tasks are derived. This works proposes an optimal control allocation scheme to exploit the MAGMaS redundancies and a general model-based force estimation method is presented. All of the proposed techniques reported in this thesis are integrated in a global architecture used for simulations and experimental validation. This architecture is extended by the addition of a tele-presence framework to allow remote operations of MAGMaS. The global architecture is validated by robust demonstrations of bar lifting, an application that gives an outlook of the prospective use of the proposed concept of MAGMaS. Another contribution in the development of MAGMaS consists of an exploratory study on the flexibility of manipulated loads. A vibration model is derived and exploited to showcase vibration properties in terms of control. The last contribution of this thesis consists of an exploratory study on the use of elastic joints in aerial robots, endowing these systems with mechanical compliance and energy storage capabilities. Theoretical groundings are associated with a nonlinear controller synthesis. The proposed approach is validated by experimental work which relies on the integration of a lightweight variable stiffness actuator on an aerial robot.

Aerial Robotic Workers CRC Press
This book demonstrates how bio-inspiration can lead to fully autonomous flying robots without relying on external aids. Most existing aerial robots fly in open skies, far from obstacles, and rely on external beacons, mainly GPS, to localise and navigate. However, these robots are not able to fly at low altitude or in confined environments, and

The Development of an Aerial Robotics Laboratory Highlighting the First Experimental Validation of Optimal Reciprocal Collision Avoidance Logos Verlag Berlin GmbH
Fundamental problems in aerial robotics include the tasks of spatial motion, spatial sensing and spatial reasoning. Reasoning in complex environments represents a difficult problem. The issues specific to spatial reasoning are planning and decision making. Planning deals with the trajectory algorithmic development based on the available information, while decision making determines priorities and evaluates potential eAn aerial robot can be termed as a physical agent that exists and flies in the real 3D world, can sense its environment and act on it to achieve specific goals. So throughout this book, an aerial robot will also be termed as an agent.

A First Course in Aerial Robots and Drones Springer
Aerial robotic manipulation integrates concepts and technologies coming from unmanned aerial systems and robotics manipulation. It includes not only kinematic, dynamics, aerodynamics and control but also perception, planning, design aspects, mechatronics and cooperation between several aerial robotics manipulators. All these topics are considered in this book in which the main research and development approaches in aerial robotic manipulation are presented, including the description of relevant systems. In addition of the research aspects, the book also includes the deployment of real systems both indoors and outdoors, which is a relevant characteristic of the book because most results of aerial robotic manipulation have been validated only indoor using motion tracking systems. Moreover, the book presents two relevant applications: structure assembly and inspection and maintenance, which has started to be applied in the industry. The Chapters of the book will present results of two main European Robotics Projects in aerial robotics manipulation: FP7 ARCAS and H2020 AEROARMS. FP7 ARCAS defined the basic concepts on aerial robotic manipulation, including cooperative manipulation. The H2020 AEROARMS on aerial robot with multiple arms and advanced manipulation capabilities for inspection and maintenance has two general objectives: (1) development of advanced aerial robotic manipulation methods and technologies, including manipulation with dual arms and multi-directional thrusters aerial platforms; and (2) application to the inspection and maintenance.

Inclusive Robotics for a Better Society Springer
The purpose of the book is to provide the basic information on the aerial robotics and how the basic quadcopter is designed using STM32 F100 RB microcontroller. What the basic mathematical equation and how a quadcopter flies in the air. In the book the basic algorithm, circuit and block

diagram are well explained. After studying this book, the reader will be able to understand and explain the basics of the quadcopter and aerial robotics
Planning and Decision Making for Aerial Robots Createspace Independent Publishing Platform
It is at least two decades since the conventional robotic manipulators have become a common manufacturing tool for different industries, from automotive to pharmaceutical. The proven benefits of utilizing robotic manipulators for manufacturing in different industries motivated scientists and researchers to try to extend the applications of robots to many other areas by inventing several new types of robots other than conventional manipulators. The new types of robots can be categorized in two groups; redundant (and hyper-redundant) manipulators, and mobile (ground, marine, and aerial) robots. These groups of robots, known as advanced robots, have more freedom for their mobility, which allows them to do tasks that the conventional manipulators cannot do. Engineers have taken advantage of the extra mobility of the advanced robots to make them work in constrained environments, ranging from limited joint motions for redundant (or hyper-redundant) manipulators to obstacles in the way of mobile (ground, marine, and aerial) robots. Since these constraints usually depend on the work environment, they are variable. Engineers have had to invent methods to allow the robots to deal with a variety of constraints automatically. A robot that is equipped with those methods is called an Autonomous Robot. Autonomous Robots: Kinematics, Path Planning, and Control covers the kinematics and dynamic modeling/analysis of Autonomous Robots, as well as the methods suitable for their control. The text is suitable for mechanical and electrical engineers who want to familiarize themselves with methods of modeling/analysis/control that have been proven efficient through research.