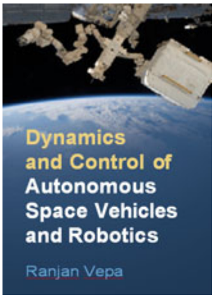

Dynamics and Control of Autonomous Space Vehicles and Robotics

R. Vepa

Cambridge University Press, University Printing House, Shaftesbury Road, Cambridge CB2 8BS, UK. 2019. xviii; 352 pp. Illustrated. £105. ISBN 978-1-108-42284-0.

Dr Ranjan Vepa received his PhD in Applied Mechanics from Stanford University in 1975 and is an expert in aerospace vehicle dynamics and control research who has studied and worked in Canada, the USA and the UK. He has worked at Queen Mary University of London since 1985 and is the author of six books written in the last decade in the areas of dynamics and control of space vehicles, robotics, unmanned aerial vehicles, aircraft, energy generation vehicles and biomimetic robotics.

Dynamics and Control of Autonomous Space Vehicles and Robotics is his most recent book. Rather than a specific focus on control systems, this book provides broad and general coverage of many related and traditional aspects of autonomy, dynamics and state estimation in the fields of space vehicles and space robots. The book also considers established technology for terrestrial robots that could be used for potential future missions.

Chapter 1 introduces a range of recent and conceptual autonomous space vehicles and robots as well as their relevant technologies. In chapter 2, sections 2.1–2.14 summarise the equations and concepts of orbital dynamics, perturbations and control, which are not usually considered in the context of autonomous systems but may be of use to researchers without a space background. More distantly related are sections 2.15–2.18, which detail launch vehicle dynamics, rocket equations and electric propulsion fundamentals that could be considered for actuator models of autonomous spacecraft. Chapter 3 returns to control fundamentals with the introduction of space vehicle attitude kinematics, dynamics, control and stability with the important quaternion representation. The author also includes useful actuator models for attitude control, such as momentum and reaction wheels, control moment gyroscopes and magnetic actuation.

In chapters 4 and 5, the complex problems of manipulator dynamics and control in free-fall gravity gradients and on mobile rovers are presented, and this could serve as a particularly useful model reference for roboticists. Chapters 6 and 7 examine the dynamics of mobile planetary rovers and robots' path planning, navigation and localisation, which is also a useful reference out of the context of space as it is a summary of field robotics methods in general. The navigation methodologies focus on probabilistic systems, particle filters and estimation methods that are proven but not (yet) popularly

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used in space robots. Chapter 8 introduces a variety of sensors and associated estimation methodologies used by space vehicles. Although cursory in parts, this is essential knowledge and recommended reading for any aspiring space roboticist.

This book is useful particularly as a single source of information for the broad spectrum of technologies related to space robotics and would be a good overview of the most established concepts and methodologies for graduate students and researchers entering the field. It would be a suitable text for a dedicated taught module in space robotics, or as a guide for graduate study in robotics, dynamics and control related to space engineering. The text is very rich in equations, figures and tables, and the treatment is very theoretical, which leads to models occasionally becoming very complex. Undergraduate students and recent graduates may find it difficult to follow in some sections without additional guidance and examples being provided.

Overall, this book is a worthwhile read for capable space roboticists looking to build or extend their knowledge of the field.

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Spacecraft Modeling, Attitude Determination and Control: Quaternion-Based Approach

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CRC Press, Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742, USA. 2019. Distributed by Taylor & Francis Group, 2 Park Square, Milton Park, Abingdon OX14 4RN, UK. xi; 327 pp. £140. (20% discount available to RAeS members via www.crcpress.com using AKQ07 promotion code). ISBN 978-1-138-33150-1.

This book provides a good and comprehensive overview of spacecraft attitude dynamics, determination and control, including advances in the quaternion-based approach, with application to practical problems such as coupled attitude and orbit control and model predictive optimal control with realistic actuator constraints. Different options for spacecraft actuation are considered, including the use of momentum exchange devices such as control moment gyros for attitude control, thruster-based reaction control systems and magnetic