



# Fundamentals of Dynamics and Control of Space Systems

*Dr. Krishna D Kumar*

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# Fundamentals of Dynamics and Control of Space Systems

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## **Fundamentals of Dynamics and Control of Space Systems** Dr. Krishna D Kumar

This book is an outcome of the lectures delivered by the author for engineering students at Kyushu University, Japan, Korea Advanced Institute of Science and Technology, South Korea, and Ryerson University, Canada. The text started when the author was at Kyushu University, Japan. The author has been doing research on the subject of “Dynamics and Control of Space Systems” for the last fifteen years. During the course of research and teaching this subject, the author realized that there is an earnest need of a text which may provide basic understanding of inherent complexity in modelling space systems including environmental forces and torques. This text fulfils this goal through a step by step approach that explains each concept in a simple way with mathematical details and simple notations. This textbook is written for engineers and students pursuing study or research on the dynamics and control of space systems. The author has used all contents of this textbook in a core course on Space Systems (one semester, four hours a week). This text assumes that the reader is well acquainted with elementary calculus and linear algebra. Enough care has been taken so that the reader may attempt different types of problems. Each concept has been discussed with sufficient mathematical background supported by examples. A complete set of problems has been added to the end of every chapter. A “Solution Manual” accompanying this book provides a solution to most of the these exercise problems. In addition, a “Laboratory Manual” with this textbook provides the practical aspects of designing space systems with a focus on the construction of a Can-sized satellite. During the course of writing I have received several suggestions and comments from my colleagues and students. I especially thank my students Aradhana Choudhuri, Mike Alger, Geoffrey McVittie, Mike Tai, Kamran Shahid, Antonio Mauro, and Tarunkumar Patel who have gone through previous drafts of this book, and provided me with valuable suggestions. Finally, I express my sincere appreciation to my parents, my wife, Annu, and children, Diksha and Saurabh for their support and patience, without which it would have been impossible to complete this book. This textbook is dedicated to my parents and family for their inspiration and support. In writing this textbook, I have tried my best to provide the best relevant materials on the subject. I encourage and welcome all comments and suggestions to make this book more relevant to the contents of your course or research study. Please address your comments to [kdkumar@ryerson.ca](mailto:kdkumar@ryerson.ca).

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