

# Preface

This monograph, which is an extension of Dr. Emadzadeh's doctoral thesis, investigates the different aspects of utilization of X-ray pulsars for navigation of spacecraft in space. In our view, the monograph possesses two unique features. First, it provides a solid mathematical formulation for the absolute and relative navigation problems based on the use of X-ray pulsar measurements. Second, it presents a comprehensive framework for the signal processing techniques needed to obtain the navigation solution.

We had several readers in mind when writing this monograph. One such group is the body of university students and researchers who work on new space navigation techniques. Using X-ray pulsars for navigation is an interesting field in which there are many new challenging problems that need to be addressed. Another target group comprises people from the industry. Deep space navigation missions, especially the ones directed beyond the solar system, have attracted a lot of attention in recent years. Employing new space navigation techniques will definitely play a key role in making such missions successful. We hope that the monograph will encourage more researchers in the area of space navigation to work on X-ray pulsar-based navigation.

The subject matter requires some familiarity with linear systems, probability, and estimation theory. The knowledge is generally assumed to be of advanced undergraduate and graduate level. It will be more beneficial, if the reader proceeds through the chapters in sequence. We first provide some basic background knowledge on pulsars and a literature review on pulsar-based navigation in Chap. 2. Then, we present the navigation problems, and develop the X-ray pulsar signal models in Chap. 3. Using these models, we formulate and analyze the pulse delay estimation problem in Chap. 3. Different pulse delay estimators are proposed in Chaps. 4, 5, and 6. Using the presented estimators, Chap. 7 provides a recursive algorithm to obtain the navigation solution. Concluding remarks and suggestions for future work are given in Chap. 8.

Finally, we acknowledge Dr. A. Robert Golshan for his valuable comments and suggestions, which helped us greatly improve the monograph.

Los Angeles, CA  
October 2010

Amir A. Emadzadeh  
Jason L. Speyer

Navigation in Space by X-ray Pulsars

Emadzadeh, A.A.; Speyer, J.L.

2011, XI, 118 p., Hardcover

ISBN: 978-1-4419-8016-8