

Using Fractional Gaussian Noise Models in Orbit Determination

Winston C. Chow and Paul W. Schumacher Jr.

Naval Network and Space Operations Command, Dahlgren, Virginia 22448-5300

[J. Guidance 26 (4), pp. 593–607 (2003)]

HERE is a re-statement of Theorem 4 in “Using Fractional Gaussian Noise Models in Orbit Determination,” published in the *Journal of Guidance, Control, and Dynamics*, Vol. 26, No. 4, pages 593–607, using a generalization that broadens functions $\{F_i : i = 1, \dots, n\}$ to a wider variety of possible transformations. In the published paper it must be one-to-one and onto for finite partitions of sets of nonzero probability. Now, the transformation need only be one-to-one and onto for finite partitions of sets that have nonzero probability and whose random variables are statistically independent. Also, the description of the partitioning in the first sentence of the proof is clarified here.

Theorem 4: Let $\{X_i : i = 1, \dots, n\}$ be an ordered set of random vectors and operator $T \equiv (T_1, \dots, T_n)$ be a transformation for which vectors $y_i = T_i(x_1, \dots, x_n) = F_i(x_i)$ for some function F_i . Define

$S_i \ni \forall x_i \in S_i, p_{X_1, \dots, X_n}(x_1, \dots, x_n) = p_{X_1}(x_1) \dots p_{X_n}(x_n)$ and $p_{X_i}(x_i) > 0$.

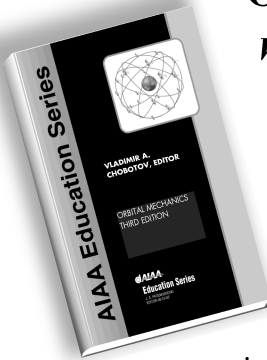
Furthermore, suppose F_i is one-to-one and onto for disjoint sets

$$S_{ij} \subseteq S_i; \bigcup_{j=1}^{k_i} S_{ij} = S_i.$$

Then, given image vectors $y_1, \dots, y_n \ni F_i^{-1}(y_i) \subseteq S_i$

$$p_{Y_1, \dots, Y_n}(y_1, \dots, y_n) = p_{Y_1}(y_1) \dots p_{Y_n}(y_n)$$

The proof proceeds as before, but with the following change: The phrase, “Because $\times_{i \neq j} S_i \times S_j$ partitions $\times_i S_i \dots$ ”, currently located in the beginning of the first sentence of the proof, should instead read: “Because the sets $\times_{i=1}^n S_{ir_i}$, where $r_i = 1, \dots, k_i$, partition $\times_{i=1}^n S_i \dots$ ”.



Orbital Mechanics, Third Edition

Vladimir A. Chobotov • The Aerospace Corporation

Designed to be used as a graduate student textbook and a ready reference for the busy professional, this third edition of *Orbital Mechanics* is structured to allow you to look up the things you need to know. This edition includes more recent developments in space exploration (e.g. Galileo, Cassini, Mars Odyssey missions). Also, the chapter on space debris was rewritten to reflect new developments in that area.

The well-organized chapters cover every basic aspect of orbital mechanics, from celestial relationships to the problems of space debris. The book is clearly written in language familiar to aerospace professionals and graduate students, with all of the equations, diagrams, and graphs you would like to have close at hand.

An updated software package on CD-ROM includes: HW Solutions, which presents a range of viewpoints and guidelines for solving selected problems in the text; Orbital Calculator, which provides an interactive environment for the generation of Keplerian orbits, orbital transfer maneuvers, and animation of ellipses, hyperbolas, and interplanetary orbits; and Orbital Mechanics Solutions.

- | | | |
|------------------|--|--|
| Contents— | <ul style="list-style-type: none"> ■ Basic Concepts ■ Celestial Relationships ■ Keplerian Orbits ■ Position and Velocity as a Function of Time ■ Orbital Maneuvers ■ Complications to Impulsive Maneuvers ■ Relative Motion in Orbit ■ Introduction to Orbit Perturbations | <ul style="list-style-type: none"> ■ Orbit Perturbations: Mathematical Foundations ■ Applications of Orbit Perturbations ■ Orbital Systems ■ Lunar and Interplanetary Trajectories ■ Space Debris ■ Optimal Low-Thrust Orbit Transfers ■ Orbital Coverage |
|------------------|--|--|



American Institute of Aeronautics and Astronautics
Publications Customer Service, P.O. Box 960, Herndon, VA 20172-0960
Fax: 703/661-1501 • Phone: 800/682-2422 • E-Mail: warehouse@aiaa.org
Order 24 hours a day at www.aiaa.org

2002, 460 pages, Hardback, with Software
ISBN: 1-56347-537-5
List Price: \$100.95 • AIAA Member Price: \$69.95