
THE ROYAL INSTITUTE OF NAVIGATION

Aims and Objects

The objects of the Institute are to unite in one body those who are concerned with or who are interested in navigation and to further its development. Navigation is conceived as applying to locomotion of all kinds and is perceived as encompassing aspects of: command and control, psychology and zoology, operational research, risk analysis, theoretical physics, operation in hostile environments, instrumentation, ergonomics, financial planning and law as well as electronics, astronomy, mathematics, cartography and other subjects traditionally associated with navigation.

The aims of the Institute are to encourage the creation and dissemination of knowledge through research and development, to co-ordinate information from all the disciplines involved, to provide a forum in which new ideas and new products can have the benefit of informed and professional scrutiny and to further education and communication. The Institute initiates conferences and symposia on specific subjects and has a programme of meetings at which lectures are given and discussed. There are standing Special Interest Groups (SIGs), which keep under constant review pertinent aspects of navigation. The success of these Special Interest Groups is crucially dependent on the active involvement of members.

The SIGs include: Land Navigation and Location Group (LN&L), General Aviation Navigation Group (GANG), History of Air Navigation Group (HANG), Civil and Military Air Group (CMAG), Marine Traffic & Navigation Group (MT&NG), Small Craft Group (SCG), Space Group (Space), Animal Navigation Group (ANG) and Research & Development Group (R&D).

The Institute publishes *The Journal of Navigation* six times a year. It contains papers which have been presented at meetings, other original papers and selected papers and reports from Special Interest Groups. The Institute also publishes *Navigation News* six times a year which contains a full account of the Institute's proceedings and activities. This includes Branch News, a record of current navigational work, a diary of events, topical articles, news about Membership and advertising. A great deal of the Institute's work is international in character and is coordinated with that of similar organisations in other countries.

Membership

There are nine classes of membership under which individuals or organisations may apply to join the Institute. Details of the various membership criteria and current subscriptions are available on the RIN website (Home / Join the RIN / Membership Types <http://www.rin.org.uk/general.aspx?ID=59>) and from the Membership Secretary (membership@rin.org.uk Tel: +44(0)20 7591 3130 Fax: 44(0)20 7591 3131).

- (1) Ordinary Membership
- (2) Associate Membership
- (3) Associate Fellow Membership
- (4) Student Membership
- (5) Junior Associate Membership
- (6) Corporate Membership
- (7) Small Business Membership
- (8) Affiliate College University Membership
- (9) Affiliate Club Membership

Additional membership classes of Fellowship, Honorary Fellowship, Retired Membership and Affiliate Membership also exist and details are available from the Membership Secretary.

The subscription price (excluding VAT) to *The Journal* (ISSN 0373-4633) for Volume 70, 2017, which includes print and electronic access, is £604 (USA, Canada and Mexico US \$1092) and includes delivery by air; single parts are available at £110 (USA, Canada and Mexico US \$197) plus postage. The electronic-only price available to institutional subscribers is £468 (USA, Canada and Mexico US \$854). EU subscribers (outside the UK) who are not registered for VAT should add VAT at their country's rate. VAT registered subscribers should provide their VAT registration number. *The Journal* is issued free to all Members of the Institute. Orders, which must be accompanied by payment, may be sent to any bookseller or subscription agent or direct to the publishers: Cambridge University Press, 100 Brook Hill Drive, West Nyack, NY 10994-2133, USA, or in the UK, Cambridge University Press, Journals Fulfillment Department, 100 Brook Hill Drive, West Nyack, NY 10994-2133, USA. Japanese prices for institutions are available from Kinokuniya Company Ltd, P.O. Box 55, Chitose, Tokyo 156, Japan.

© 2017 The Royal Institute of Navigation

THE JOURNAL OF NAVIGATION

VOLUME 70 NUMBER 4 JULY 2017

CONTENTS

- The Cinderella Navigation Aid The use of the Lead and Line in British ships from the 16th to 20th Century** 671
John Kemp
- Accounting for Inter-System Bias in DGNSS Positioning with GPS/GLONASS/BDS/Galileo** 686
Hui Liu, Bao Shu, Longwei Xu, Chuang Qian, Rufe Zhang and Ming Zhang
- Distributed Stochastic Search Algorithm for Multi-ship Encounter Situations** 699
Donggyun Kim, Katsutoshi Hirayama and Tenda Okimoto
- Mars Cruise Orbit Determination from Combined Optical Celestial Techniques and X-ray Pulsars** 719
Jiandong Liu, Erhu Wei and Shuanggen Jin
- A Unified Indexing Strategy for the Mixed Data of a Future Marine GIS** 735
Tao Liu, Xie Han, Jie Yang and Liqun Kuang
- Joint Position Localisation of Spacecraft and Debris for Autonomous Navigation Applications using Angle Measurements Only** 748
Ranjan Vepa
- Data Reception Analysis of the AIS on board the TianTuo-3 Satellite** 761
Shiyu Li, Xiaoqian Chen, Lihu Chen, Yong Zhao, Tao Sheng and Yuzhu Bai
- Risk Assessment of Operational Safety for Oil Tankers - A Revised Risk Matrix** 775
Wen-Kai Hsu, Shu-Jun Lian and Show-Hui Huang
- Robust Positioning, Preliminary Orbit Determination, and Trajectory Prediction of Space Debris using In-Space Iterative-Bearing-Only Observations** 789
MA Amiri Atashgah, MR Torkamani and Abolfazl Lavaei
- Unbiased Nonlinear Least Squares Estimations of Short-distance Equations** 810
Shuqiang Xue and Yuanxi Yang
- X-ray Pulsar/Starlight Doppler Deeply-integrated Navigation Method** 829
Yidi Wang, Wei Zheng and Dapeng Zhang
- Study of Automatic Anomalous Behaviour Detection Techniques for Maritime Vessels** 847
Abdoulaye Sidibé and Gao Shu
- Fuel Consumption Ratio Analysis for Transiting from Various Ports and Harbours in Asia through the Northern Sea Route** 859
Ming-Tao Chou, Tsung-Yu Chou, Yu-Ru Hsu and Chi-Pao Lu
- Collision Risk Modelling of Supply Vessels and Offshore Platforms Under Uncertainty** 870
Andrew John and Umukoro Johnson Osue
- ADS-B: Probabilistic Safety Assessment** 887
Busyairah Syd Ali, Washington Yotto Ochieng and Arnab Majumdar
- An Augmented Strapdown Inertial Navigation System using Jerk and Jounce of Motion for a Flying Robot** 907
Milad Bayat and MA Amiri Atashgah

Cambridge Core

For further information about this journal
please go to the journal website at:
cambridge.org/nav



MIX
Paper from
responsible sources
FSC® C007785

CAMBRIDGE
UNIVERSITY PRESS