# Proceedings of the CAMBRIDGE PHILOSOPHICAL SOCIETY

## (MATHEMATICAL AND PHYSICAL SCIENCES)

**VOLUME 57** 

PART 3

CAMBRIDGE UNIVERSITY PRESS

BENTLEY HOUSE, 200 EUSTON ROAD, LONDON, N.W. 1 AMERICAN BRANCH: 32 EAST 57TH STREET, NEW YORK 22, N.Y.

Price Thirty-eight Shillings Net (U.S.A. \$6.50)

Subscription price per volume £6. 10s. net post free (\$23.50 in U.S.A.)

July 1961

#### CAMBRIDGE PHILOSOPHICAL SOCIETY FOUNDED 1819; ROYAL CHARTER 1832

#### Session 1960–1961

#### President: E. J. H. CORNER

Vice-Presidents: J. D. BOYD, F. P. WHITE, F. P. BOWDEN

Treasurer: R. C. EVANS

Secretaries: (Mathematical) J. H. WILLIAMSON

(Physical) T. E. FABER

#### (Biological) S. SMITH

The publications of the Society consist of the *Proceedings* and of the *Biological Reviews*. The publication of *Transactions* was suspended at the end of Volume XXII.

Orders should be sent to: THE MANAGER, CAMBRIDGE UNIVERSITY PRESS, BENTLEY HOUSE, 200 EUSTON ROAD, LONDON, N.W.1. Enquiries from the U.S.A. should be addressed to the Cambridge University Press, American Branch, 32 East 57th Street, New York 22, U.S.A.

For the purchase of early parts of the *Transactions*, *Proceedings* and *Biological Reviews* application should be made to the Secretaries. All parts of the *Proceedings* and *Biological Reviews* are available, and prices of sets or single parts will be quoted on application.

Fellows and Associates of the Society are particularly requested to inform the Secretaries of any change of postal address, and to send their subscriptions to the Treasurer, CAMBRIDGE PHILOSOPHICAL SOCIETY, FREE SCHOOL LANE, CAMBRIDGE.

All correspondence regarding library exchanges and Fellows' copies should be addressed to the Secretaries at the Society's office.

### PROCEEDINGS of the CAMBRIDGE PHILOSOPHICAL SOCIETY

#### edited by J. H. WILLIAMSON

in consultation with P. C. CLEMMOW F. SMITHIES T. E. FABER F. URSELL E. R. LAPWOOD A. M. WALKER

E. C. ZEEMAN

1. Four parts of the *Proceedings* are issued each year.

2. Communications for the *Proceedings* should be sent to *The Librarian*, *Cambridge Philosophical Society*, *Free School Lane*, *Cambridge*. Papers by Fellows and Associates of the Society should be communicated directly by the author. Other papers must be communicated by a Fellow, who in doing so should give his opinion on the suitability of the paper for publication.

3. Papers occupying more than twenty pages of print can only rarely be accepted.

4. It is recommended that each paper be prefaced by a short abstract. Copies of a *Guide* for the Preparation of Synopses, prepared by the Abstracting Services Consultative Committee and issued by the Royal Society, may be obtained from the Librarian.

5. Drawings for illustration and diagrams should be on a large scale and on smooth white Bristol board in Indian ink. Lettering should be written clear of the diagram, and the desired position of the lettering indicated by pencilled lines.

6. References should be listed at the end of each paper. Titles of journals listed in *Mathematical Reviews*, should be abbreviated as in *Mathematical Reviews*, except that proper names should be given in full. First and last page numbers should be given where relevant.

7. Authors are particularly requested to prepare their manuscripts in a form suitable for printing, with adequate margins. A pamphlet on the preparation of papers may be obtained from the Librarian. If a large number of corrections are required in the proofs, the Council reserves the right to make a charge towards the cost.

8. Authors may receive, on request, free offprints of *Proceedings* papers (fifty for a sole author, and a smaller number for each joint author).



The Institution of Electrical Engineers

> Advertisement Department

Savoy Place London, W.C. 2 COVENT GARDEN 1871

#### THE JOURNAL The monthly JOURNAL goes to all members of The Institution, to non-

members and subscribers. It contains authoritative articles dealing with all realms of electrical engineering. It also presents a synoptic review of Institution events and serves as the main channel of communication with the professional electrical engineer. Circulation 45,691.

## THE PROCEEDINGS

Part 'A'. Contains original academic papers describing new work in the heavycurrent sphere of electrical engineering, covering power generation—transmission —distribution—installation; as well as reviews of progress. Published bimonthly (February, April, June, August, October and December) with a wholly subscribed circulation of 17,800.

INSTITUTION OF

ELECTRICAL ENGINEERS

THE INSTITUTION OF ELECTRICAL ENGINEERS

TARE &

The Martin Constant and -

Part 'B'. Contains original academic papers describing new work in the lightcurrent sphere of electrical engineering, covering telecommunication—radio engineering—electronics; as well as reviews of progress. Published bimonthly (January, March, May, July, September and November) with a wholly subscribed circulation of 14,900.

FULL PARTICULARS OF SUBSCRIPTION AND ADVERTISEMENT RATES FOR THE

## JOURNALS

### PUBLISHED BY THE

## CAMBRIDGE UNIVERSITY PRESS

MAY BE HAD FROM

THE MANAGER, CAMBRIDGE UNIVERSITY PRESS BENTLEY HOUSE, 200 EUSTON ROAD LONDON, N.W. 1

Camb. Phil. Soc. Proc. 57, 3

## Radio Waves in the Ionosphere K. G. BUDDEN

A full account of the mathematical basis of the theory of the propagation of radio waves in a horizontally stratified ionosphere. It is both a textbook for students and a reference work for practising engineers and research workers in radio communications. 95s. net

## Numerical Methods of Curve Fitting

#### P. G. GUEST

A comprehensive account of methods for reducing sets of observations and for fitting curves to numerical data, bringing together many treatments hitherto published only in original papers. Full derivations are given of the formulae used. 80s. net

CAMBRIDGE UNIVERSITY PRESS

## **JOURNAL OF THE SOCIETY FOR** INDUSTRIAL AND APPLIED MATHEMATICS 1961

#### VOLUME 9, NUMBER 1, MARCH 1961

The Constrained Gradient Method of Linear Programming. C. E. LEMKE

An Out-of-Killer Method for Minimal-Cost Flow Problems. D. R. FULKERSON

The Deflation of Eigenvalue Problems with Second-Order Ordinary Differential Operators. D. D. MORRISON

Integration Procedures Which Minimize Propagated Errors. T. E. HULL and A. C. R. NEWBERY Numerical Representation of Utility. ISIDORE FLEISCHER Self-Dual Quadratic Programs. W. S. DORN

Ordering Systems of Equations. JAMES G. JEWELL

An Algorithm for Finding All Vertices of Convex Poly-hedral Sets. M. L. BALINSKI

On Deflating Matrices. A. S. HOUSEHOLDER

Some Applications of Quadrature by Differentiation. WILLIAM SQUIRE

Note on Fitting of Functions of Several Independent Variables. T. N. E. GREVILLE

Two Theorems in Multi-Weighted Sums. B. R. MYERS

A Method for the Numerical Calculation of Hydrodynamic Flow and Radiation Diffusion by Implicit Differencing. CARL A. ROUSE

Stability Criteria and the Real Roots of a Transcendental Equation. E. M. WRIGHT

Finite-Difference Techniques for a Boundary Problem with an Eigenvalue in a Boundary Condition. LOUIS W. EHRLICH, JAMES D. RILEY, W. GILBERT STRANG and B. ANDREAS TROESCH

The Journal is published quarterly. Subscriptions are \$10.00 per volume

Orders should be placed with the

SOCIETY FOR INDUSTRIAL AND APPLIED MATHEMATICS

Box 7541, Philadelphia 1, Pennsylvania, U.S.A.

(ii)

## ROYAL STATISTICAL SOCIETY

THE JOURNAL OF THE ROYAL STATISTICAL SOCIETY is published in two series: SERIES A (GENERAL), four issues a year, annual subscription £4. 4s. (U.S. 12.00) post free; SERIES B (METHODOLOGICAL), two issues a year, annual subscription £3. 2s. (U.S. 9.00) post free.

### Contents of Series B (Methodological), Vol. 23, Part 1, 1961

Consistency in Statistical Inference and Decision. By C. A. B. SMITH. (With Discussion.) Delays on a Two-Lane Road. By J. C. TANNER.

- A Queueing Model for Road Traffic Flow. By A. J. MILLER. (With Discussion on the two papers.)
- An Unbiased Estimator for Powers of the Arithmetic Mean. By G. J. GLASSER.
- A Bulk Service Queueing Problem with Variable Capacity. By N. K. JAISWAL.

A Simple Method of Trend Construction. By C. E. V. LESER.

The Real Stable Characteristic Functions and Chaotic Acceleration. By I. J. GOOD.

Reply to Mr Quenouille's Comments about My Paper on Mixtures. By H. SCHEFFÉ.

- An Asymptotic Efficiency of Daniels's Generalised Correlation Coefficients. By D. J. FARLIE.
- The Average Run Length of the Cumulative Sum Chart When a V-Mask is Used. By K. W. KEMP.
- The Time-Dependent Solution for an Infinite Dam with Discrete Additive Inputs. By G. F. YEO.

Confidence Limits for Multivariate Ratios. By B. M. BENNETT.

- Estimation of the Parameters of a Linear Functional Relationship. By M. DORFF and J. GURLAND.
- A Note on Vacancies on a Line. By F. DOWNTON,

Inaccuracy and Inference. By D. F. KERRIDGE.

A Simple Congestion System with Incomplete Service. By D. R. Cox.

A Test of Homogeneity for Ordered Variances. By S. E. VINCENT.

The Solution of Queueing and Inventory Models by Semi-Markov Processes. By A. J. FABENS.

A Note on the Renewal Function when the Mean Renewal Life Time is Infinite. By W. L. SMITH.

The Moment Generating Function of the Truncated Multi-Normal Distribution. By G. M. TALLIS.

Obtainable through any bookseller or direct from:

## ROYAL STATISTICAL SOCIETY

#### 21 BENTINCK STREET, LONDON, W.1

(iii)

The Nelson Philosophical Texts

## Duns Scotus: Philosophical Writings edited by ALLAN WOLTER OFM

This selection from the philosophical writings of Duns Scotus is taken from his Ordinatio, better known as his Oxford Commentary on the Sentences of Peter Lombard, and is here printed in Latin with an English translation. It presents his views on the chief aspects of the questions concerned with God and the human soul. Two questions deal with the existence and unicity of God, two questions with the human soul, one concerning its spirituality and its immortality, the other its ability to attain certain knowledge.

Half-tone frontispiece

Demy 8vo

xxiv + 360 pp

305

## already published

Hume: Theory of Knowledge edited by D. C. YALDEN-THOMSON	1 2s 6d
Hume: Theory of Politics edited by F. M. WATKINS	1 2s 6d
Descartes: Philosophical Writings edited by P. T. GEACH and G. E. M. ANSCOMBE	185
Ockham: Philosophical Writings edited by P. BOEHNER	215
Plato: Socratic Dialogues edited by W. D. WOODHEAD	185
Rousseau: Political Writings	
edited by F. M. WATKINS	1 2s 6d
Berkeley: Select Political Writings edited by T. E. JESSOP	1 25 6d

## NELSON

(iv)