NBS

Technical Note 127

BIBLIOGRAPHY ON DIRECTION FINDING AND RELATED IONOSPHERIC PROPAGATION TOPICS 1955-1961

OLAF D. REMMLER

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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127

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ABSTRACT

This bibliography is an outgrowth of a conference held at the University of California at Los Angeles in June 1960 to discuss the aspects of long-range high-frequency radio propagation that affect radio location and direction finding, and the related problems of measurement and analysis. A group of the papers presented at the conference was published in the Radio Propagation Section (Section D) of the Journal of Research of the National Bureau of Standards, May - June issue, 1961. In connection with the conference the Numerical Analysis Research Staff of UCLA prepared a bibliography of published work on the conference subject covering the period 1955-1959. For this Technical Note the UCLA bibliography has been edited and extended to include some papers published in 1960 and the first half of 1961. This compilation, though by no means exhaustive, includes over 850 titles on direction finding and related topics ranging from instrumental details through observations and data analysis to theories of propagation.

Bibliography on Direction Finding and Related Ionospheric Propagation Topics (1955-1961)

Introduction

In June 1960 a conference on transmission problems related to high-frequency direction finding was held at the University of California at Los Angeles under its sponsorship and in cooperation with the Office of Naval Research. The purpose of the conference was to discuss the aspects of long-range high-frequency radio propagation that affect radio location and direction finding, and the related problems of measurement and analysis. A group of the papers presented at the conference was published in Radio Propagation, Section D of the Journal of Research of the National Bureau of Standards (Volume 65D, Number 3, May-June 1961).

In connection with the conference the Numerical Analysis Research Staff of the University of California at Los Angeles prepared a bibliography of published work on direction finding and related topics for the period 1955-1959, which formed the basis for this Technical Note. For the present work the UCLA bibliography was edited and extended to include some of the papers published in 1960 and the first half of 1961 as well as some earlier ones which came to the editor's attention.

The selection of titles to be included in this bibliography was based on a rather broad interpretation of direction finding and related topics. The topics range from instrumental details through observations and data analysis to theories of propagation. Such breadth of coverage militates against exhaustiveness especially in fields not closely related

to direction finding in the narrow sense of the term. Nevertheless it is hoped that a representative sample of papers from these fields has been included; at least enough to suggest some new approaches or solutions to some users of the bibliography. The editor would appreciate comments on the work, particularly in regard to serious omissions, new developments, or errors of citation. These will be collected for use if future supplements or revisions are decided upon; the communications would probably influence the decision.

The bibliography was brought up to date principally by searching all issues of Electrical Engineering Abstracts from January 1960 through July 1961 under the relevant subjects. In addition, certain recent bibliographies and the reference files of some NBS personnel were searched for pertinent titles. The bibliographies on radio wave propagation edited by Wilhelm Nupen and listed under his name were particularly useful. Another important source was the Backscatter Literature Survey prepared by Hagn, Nielson, and Smith. Their contributions and those of the NBS personnel whose files were opened to the editor are gratefully acknowledged.

References to individual articles have been confined to the period 1955 through about mid-1961, unless the article was a review of the field. General works such as bibliographies, proceedings of conferences, surveys, and textbooks were included as far back as about 1940 in order to provide access to the earlier literature. Such general works were accepted with an even broader interpretation than the individual articles; some indication of their usefulness is given by mentioning the number of references, the inclusion of abstracts and so forth.

During World War II both sides did extensive work on radio direction finding, the results of which were largely classified. Since then much of the literature and many of the original laboratory reports have been declassified. Some bibliographies and surveys of this literature are listed herein under the name of the country in which the research was carried out. A more complete bibliography and a discussion of some of the wartime work is given in a paper by K. A. Norton entitled "Radio Wave Propagation During World War II" published in Proc. IRE for May 1962. The editor is grateful to Mr. Norton for providing a copy of this paper prior to its publication.

Since the principal emphasis was to be on long-distance propagation, only a few papers on tropospheric propagation have been retained. These include some papers indicating the magnitude of tropospheric refraction and some whose theory or techniques could be applied to long distance direction finding. A recent tropospheric bibliography is listed under R. L. Abbott.

"A Survey and Bibliography of Recent Research in the Propagation of VLF Radio Waves" by James R. Wait was published as NBS Technical Note No. 84 in May 1960. Therefore the present listing includes only references to later published works not included in his bibliography.

The titles are arranged alphabetically by the first author's name and when there is more than one author by the names of the co-authors. When there is more than one paper by the same author, or authors, the arrangement is chronological. Occasional titles are listed under the institution or organization issuing them. Similar articles by the same author but published in different journals have sometimes been included for the convenience of users having access to only one of the journals.

The abbreviations of the names of periodicals are mostly those used by Chemical Abstracts. The titles of articles in foreign journals are given in English followed by the original journal citation in transliteration and an indication of whether the journal or article has been translated (when such information was available). No attempt has been made to give the complete citation of the article in the translated journal since this usually agrees with the original except for pagination. Whenever possible the citation includes volume number, issue number, month and year to assist the user in locating references even when there is a typographical error in one of these.

Since there are over 850 titles in the bibliography, a group of code letters was devised to classify the articles according to broad subject and type. Opposite each author's name there is a key consisting of a year and from one to three letters indicating the most important categories into which the paper can be classified. In most cases the year of publication is given in the key. However, for conference proceedings the year of the conference is usually given in the key and the year of publication in the citation. For translated textbooks the key shows the year of publication in the original language and the citation the year of publication in English.

A list of the categories and some of the topics placed in each is given below. It should be noted that the selection of categories was most frequently based on the title and abstract of the paper and often on the title alone. Despite these shortcomings, it is hoped that by merely scanning the keys the user will be able to find the types of articles in which he is interested.

I would like to thank Mrs. Dorene Briels for her help in preparing the card file of references used to bring this bibliography up to date. I am especially grateful to Mrs. Marion Andrews for checking many of the citations, merging the card file and the original list while typing the manuscript, and patiently making corrections on the copy.

O. D. Remmler
Editor

Letter Key for Bibliography on Direction Finding and Related Topics

List of Topics Included in Categories

Letters(s)	Category	Kind of Topics Included
B	Bibliographies	Bibliographies; Literature Surveys; Articles known to contain many references
C	Conferences	Proceedings of conferences, meetings, symposia
S	Surveys	Surveys; reviews; monographs
Te	Texts	Textbooks
M	Miscellaneous	Manuals; handbooks; theses; project reports; general works other than those above
D	Direction Finding	Specifically concerned with direction finding or angle of arrival in the narrow sense of the term
A	Antennas	Especially narrow beam; steerable; scanning; phased arrays; interferometers; azimuthal or vertical
N	Navigation	Aircraft navigation, collision avoidance and landing systems; space vehicle tracking; aircraft tracking; shipboard navigation
P	Propagation	Ionospheric theories; refraction or bending; scattering; interference; fading; reflection; ground constant measurements; atmospheric measurements; ionospheric measurements and characteristics; ray tracing; directional propagation theories

Letters(s)	Category	Kind of Topics Included
R	Radar	Especially when concerned with determining azimuth or elevation; radar techniques or instrumentation of possible use in direction finding systems
I	Instrumental	Instruments; measuring systems and techniques; instrument testing and checking; errors in systems; directional navigation aids; phase measurement; antenna pattern measurements
O	Observational	Ionospheric data or measurements; both azimuthal and vertical direction of arrival measurements; back-scatter; properties of earth or atmosphere; analysis of author's observations
St	Statistical	Statistical theory; statistical analysis of observations; statistical methods
Th	Theoretical	Physical theories; fundamental principles; non-statistical mathematical derivations; calculations based on theory; analysis of other author's observations; relation of theories to observations; theory of antennas

DISTRIBUTION OF TITLES AMONG CATEGORIES

Total Number of Titles - 856

Letter	Category	Number of titles with letter
B	Bibliographies	24
C	Conferences	18
S	Surveys	54
Te	Texts	15
M	Miscellaneous	11
D	Direction Finding	159
A	Antennas	158
N	Navigation	54
P	Propagation	393
R	Radar	66
I	Instrumental	282
O	Observational	190
St	Statistical	37
Th	Theoretical	232

Total Number of Letters Used - 1693

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