THE ELEMENTS OF ALTERNATING CURRENTS

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649179480

The elements of alternating currents by W. S. Franklin & R. B. Williamson

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

www.triestepublishing.com

W. S. FRANKLIN & R. B. WILLIAMSON

THE ELEMENTS OF ALTERNATING CURRENTS

Trieste

THE

ELEMENTS

OF

ALTERNATING CURRENTS

BY

W. S. FRANKLIN

AND

R. B. WILLIAMSON

New York

THE MACMILLAN COMPANY

LONDON: MACMILLAN & CO., LTD.

1899

THE NEW ERA PRINTING COMPANY
LANCASTER, PA.
U. S. A.

PREFACE.

THIS book represents the experience of seven years' teaching of alternating currents, and almost every chapter has been subjected repeatedly to the test of class-room use. The authors have endeavored to include in the text only those things which contribute to the fundamental understanding of the subject and those things which are of importance in the engineering practice of to-day.

It may be taken for granted that the authors are deeply indebted to Mr. C. P. Steinmetz, whose papers are unique in their close touch with engineering realities. W. S. F.

SOUTH BETHLEHEM,
June, 1899.

TABLE OF CONTENTS.

SYMBOLS.

i instantaneous value of current.

$\boldsymbol{I}$ maximum value of an harmonic alternating current.

I effective value of an alternating current.

e instantaneous value of e. m. f.

$\boldsymbol{E}$ maximum value of an harmonic alternating e. m. f.

E effective value of an alternating e. m. f.

r R resistance (r sometimes used for radius).

L inductance.

J electrostatic capacity.

t time.

T Z turns of wire.

s turns of wire per unit length of a coil.

n speed in revolutions per second.

f frequency in cycles per second.

ω frequency in radians per second.

μ magnetic permeability.

l length.

q sectional area.

N magnetic flux.

B flux density.

THE ELEMENTS OF ALTERNATING CURRENTS.

CHAPTER I.

INDUCTANCE AND CAPACITY.

1. Magnetic flux.—Let a be an area at right angles to the velocity of a moving fluid, and let v be the velocity of the fluid. Then av is the flux of fluid across the area in units volume per second. Similarly the product of the intensity, f, of a magnetic field into an area a at right angles to f is called the magnetic flux across the area. That is

$$N = fa \qquad \text{(i)}$$

in which N is the magnetic flux across an area a which is at right angles to a magnetic field of intensity f.

The unit of magnetic flux is the flux across one square centimeter of area at right angles to a magnetic field of unit intensity. This unit flux is called a *line of force* * or simply a *line*. For example, the intensity of the magnetic field in the air gap between the pole face of a dynamo and the armature core is, say, 5000 units, and this field is normal to the pole face of which the area is 300 square centimeters, so that 1,500,000 lines of magnetic flux pass from the pole face into the armature core.

The trend of the lines of force near the poles of a magnet is shown in Fig. 1. In Fig. 2 is shown the trend of the lines of force through a coil of wire in which an electric current is flowing.

* A line of force is a line drawn in a magnetic field so as to be in the direction of the field at each point. The term *line of force* is used for the unit flux for the following reason: Consider a magnetic field. Imagine a surface drawn across this field. Suppose this surface to be divided into *parts* across each of which there is unit flux. Imagine lines of force drawn in the magnetic field so that one line of force passes through each of the *parts* of our surface. Then the magnetic flux across any area anywhere in the field will be equal to the *number of these lines* which cross the area.