

PRINCIPLES OF TRANSDUCER DEVICES AND COMPONENTS

Edited by

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Chapter 10

BASIC CONCEPT OF INDUCTANCE FOR INDUCTIVE TRANSDUCERS

ATIKA ARSHAD, RUMANA TASNIM, SHEROZ KHAN, AHM ZAHIRUL ALAM

10.0 INTRODUCTION

Inductance is a property exhibited by a circuit element, called inductor. This property is a result of a changing magnetic field associated with a coil of given number of turns wound on air core or core of some materials. Accordingly inductance depends on the geometrical dimensions, and the turns and the core used. Invariably the most important cause for a magnetic field is the current flowing through the turns. If current is varying with time, the magnetic field is varying with time. A time-varying magnetic field includes a voltage in any conductor linked by the field, and as a result the coil causes a drop in the voltage applied. The circuit parameter of inductance displays a dormant behavior for a continuous current flow. The coil breaks its non-dormant behavior open when the current flow experiences a change.

10.1 INDUCTORS

An inductor is a passive circuit component that stores (does not consume) electrical energy in the form of magnetic field [1]. In the beginning of flow of current (even direct current), an inductor shows up to be highly resistive, and once magnetized, the inductor becomes like a conductor. Inductance of an inductor, L can be defined as the minus emf induced in a coil divided by the rate of the current in that coil as represented in Eq. (10.1). Unit is in henrys (H), and it is graphically represented as a coiled wire wound around a non-conductive core.

$$L = - \frac{\text{emf induced in a coil}}{\frac{di}{dt}} \quad (10.1)$$

10.2 STORED ENERGY IN INDUCTOR

Generally speaking, inductor is a device which temporary stores energy in the form of magnetic field (as in Figure 10.1). Inductors are usually coils of wire, and one of the basic properties of electromagnetism is that when current flows through a wire, it creates a small