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Development of Magnetic Field Visualization System Using Hall Device Array Probe

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This paper describes the development of a magnetic field visualization system that enables measurement of all three components of an arbitrary magnetic field using a Hall device array probe and that produces visual images of the magnetic field on a computer display. With the aid of this system, understanding of the magnetic field is more easily obtained than with the conventional magnetic flux meter, which presents measurement data only at one point and in one direction.

1. Introduction

Many different magnetic devices are in common use, such as large-sized superconducting magnets, motors and transformers, or small-sized devices such as magnetic heads. Currently, optimization of the arrangement and design of the magnetic field for high efficiency and miniaturization is in demand in these magnetic apparatus. Numerical analysis of the magnetic field is especially useful for design purposes.[1]

In the magnetic flux measurement method, an apparatus equipped with a magnetic sensor such as a Hall device or a pick-up coil is used and measurement can only be made at one point and in one direction. However, a magnetic field is a vector quantity having three components. Therefore, it is difficult to estimate magnetic field if it is measured by one sensor since the measurement of three components is required.[2] This is especially true when the magnetic field shows a nonlinear behavior, as in ferromagnetic materials. Therefore, it is necessary not only to measure the