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Two Oscillatory Systems Coupled with a Gyrator

Ikuo YOSHINO  (吉野 郁男)

The ideal gyrator element can be constructed in a very good approximation using transistor amplifiers.

This paper presents some useful properties of the gyrator as antireciprocal circuit element, and simulation of dynamical equations of a gyroscope by network equations of two oscillatory systems coupled with a gyrator.

A circuit with negative inductances corresponds to a gyroscope with high center of gravity.

This circuit has some interesting properties which have never consisted of other oscillatory circuits.

The author considers nonlinear characteristic of the gyrator and the negative impedance converter and analyzes nonlinear differential equations using the method of slowly varying parameters.

Lastly the author considers about nonlinear terms in the equations, and shows a typical circuit model of a gyroscope containing a gyrator, controlled current sources, negative inductances, capacitances, and resistances.

Fundamental Studies of Fiber Reinforced Plastics

Hiroyoshi HASHIMOTO  (橋本 弘義)

1) Unsaturated polyester: Styrene copolymers are used for fiberglass reinforced plastics (FRP). The mechanical strength of the resin increases remarkably by reinforcing with fiberglass. The tensile strength of resin is extremely small in comparison with fiberglass. And the tensile strength of FRP almost depends on the strength of fiberglass.

It was found that an increase in the content of fiberglass in FRP produces an increase in its tensile strength.

Moisture proof of FRP can be predicted to increase if chemical bonding can be introduced between fiberglass and resin. Surface treatment of fiberglass was carried out with organic silane (3,4-Epoxy-cyclohexyl-ethyl-trimethoxy-silane). Chemical bonding could be introduced between fiberglass and resin, and hence the wet strength of FRP was increased.

2) Grafting polystyrene onto fiberglass: Heat-treated (450°C) fiberglass was im-
mersed in TiCl₄ for 30~300 sec and kept in styrene monomer 24 hrs at -78°, 0°, or room temperature. After washing with benzene, the fibers were seemed to carry a graft copolymer from microscopic observation. Microscopic examination showed that the resinous materials were not uniformly distributed on fiberglass.

However, when the fiberglass was observed through microscope, the presence of polystyrene could not be clearly observed.

Absorption bands of polystyrene were not observed in the IR spectrum, while those of H₄TiO₄ were observed.

Moreover, the bands which show the existence of crystal structure due to isotacticity of polystyrene prepared in this experiments were not also observed in the IR spectrum.

Study of the Fundamental Characteristics of Paper and Converted Paper

Yoshiaki HIRABAYASHI (平林義彰)

The effects of temperature on tensile strength (TS) were studied.

(1) To obtain the first-hand information, the strength of some newspapers, printing papers, wrapping papers, photo-sensitized papers, photo-sensitized papers, kraft papers, and clupak were measured at the range of temperatures of -40°C to 130°C. The maximum value of TS appeared between 40°C and 60°C. The moisture content of the paper gave influence on both the TS and elongation, but below 0°C it was difficult to find a rigid relation.

(2) The experiments were carried out on papers made from kraft pulps of unbleached deciduous wood (ULKP) and coniferous wood (UNKP). The maximum value of TS from paper from highly-beaten pulp was found at 50°C, but the paper from low degree of beating showed a linear decrease in TS with the increase of temperature.

The atmospheric moisture gave marked influence on TS of paper below 0°C, so no accurate results were obtained.

The TS of wet paper gave about two to four times large values at -40°C. This increase in TS was probably due to the fact that at -40°C the free water in the paper froze and contributed the strength of the papers.