Abstract of Recent Papers Published in the Issues of "Rev. Commun. Res. Lab."

Abstract of Research Papers Published in the Issues of "Review of the Communications Research Laboratory" (in Japanese), Vol. 40, No. 3, 1994

A SELF-ORGANIZING MODEL OF WALKING PATTERNS OF INSECTS

Shinichi KIMURA, Masafumi YANO, and Hiroshi SHIMIZU

A new self-organizing neural network model of the walking pattern of insects in response to changing circumstances, incorporates the following ideas: 1) The cerebrum sends only a few commands to the central pattern generator (CPG), which act as constraints to self-organize the walking patterns in the CPG. 2) The neural network of the CPG is composed of oscillating elements such as the KYS oscillator, which has been shown to effectively simulate the diversity of the neural activities (manuscript in preparation).; and 3) We introduce a rule to coordinate leg movement, in which the excitatory and inhibitory interactions among the neurons act to optimize the efficiency of the energy transduction of the effector organs. We describe this mechanism as "the least dissatisfaction for the greatest number of elements," which is a self-organization rule in the generation of walking patterns. By this rule, each leg tends to share the load as efficiently as possible under various circumstances.

TRANSIENT RESPONSE OF A PULSE WAVE RADIATED FROM A SLOT ARRAY RADAR ANTENNA

Teruo TEJIMA, Yoshiaki ICHINO, Akira SUZUKI, and Katsusige HARIMA

The transient response is examined of a pulse wave radiated from a slot array antenna mainly using computer simulation. Slot array antennas are used for shipboard radar. The antennas used here are between 2 and 4 meters long. As a result, it is recognized that the transient response generated at the rising (or descending) point of a pulse wave and the level are nearly equal to each peak level of a side-lobe antenna pattern.

MINIATURE Nd: YVO4 MICROCHIP LASER

Masaharu HYODO, Katsuyuki KASAI, Jun ZHOU, Mitsuo ISHIZU, and T. CARTY

Laser-diode-pumped microchip lasers have several advantages over traditional lasers, such as compactness and single-mode oscillation without additional cavity elements, but the size of the laser and pumping power range for single-mode operation are restricted by the pump-beam focusing optics. The output power and mode structure of the microchip laser depend strongly on the pump-beam spot size parameter Ω . We demonstrate a miniature Nd: YVO₄ microchip laser with simple pump-beam focusing optics and obtain small circular spot sizes by making changes in the position of the focusing lens. Using a pump-beam with an intensity radius $\Omega = 106 \,\mu\text{m}$ we obtain 314 mW of multi-longitudinal mode TEM₀₀ oscillation for 638 mW of absorbed pump power, and by decreasing the pump power, obtain a maximum single-mode $\lambda = 1.064 \,\mu\text{m}$ output of 93 mW. We show that these results agree well with the simple end-pumped rate equation model.

COMMUNICATION CHANNEL SIMULATOR FOR DIGITAL LAND MOBILE RADIO —PART I: STUDY OF MODEL FOR GENERATING ERROR SEQUENCE—

Hideichi SASAOKA

For digital communication channels with memory, the performance of error control schemes—such as feed-forward error correction and automatic repeat request—depends not only on the bit error rate but also on the error sequence. The error sequence data is therefore important to precisely evaluate the performance of communication systems with error control schemes.

This paper discusses methods of obtaining the error sequence data in digital land mobile radio channels and proposes the new concept of a digital communication channel simulator. The simulator is an error sequence generator that implements the algorithm based on an error generation model and operates in real-time using digital signal processors. The investigation is focused on the error generation algorithm, which represents a finite Markov chain model, and its suitability for digital land mobile radio communications. This paper examines the availability of a new model for error sequence generation and shows the method of determining simulation parameters.

COMPLEXITY REDUCED DECISION FEEDBACK EQUALIZER USING INTERPOLATION FOR LAND MOBILE COMMUNICATION SYSTEMS

Seiichi SAMPEI and Yukiyoshi KAMIO

This paper proposes a method that can be used to reduce the number of computations needed for a decision feedback equalizer (DFE) in land mobile communication systems. With this method, the initial acquisition process is carried out at both preamble and postamble for each burst. Optimum tap gain vectors C_{pre} and C_{post} are obtained at the end of the preamble and postamble using the conventional recursive least squares (RLS) algorithm. The optimum tap gains for information symbols located between the preamble and postamble are estimated by linearly interpolating C_{pre} and C_{post} . This method is applied to a 512-ksymbol/s and QPSK/TDMA system and is evaluated by computer simulation. The results show that the performance of this scheme is almost the same as that of a conventional RLS-DFE with only 1/7 the number of computations needed.

210

RESEARCH AND DEVELOPMENT ON HIGH DATA RATE SATELLITE COMMUNICATION SYSTEMS

Naoto KADOWAKI

Research and development of high data rate (HDR) networks is one of the most rapidly growing topics in the communications technology world. Many experimental or operational projects to develop HDR networks are planned in the United States, Europe and Japan. Although the most of such projects are based on fiber-optic-network technology, communication satellites will play an important role in HDR networks. The satellite system's advantages such as wide area coverage, flexible and quick node deployment capability, and multi-casting capability are recognized to be very important for constructing global information infrastructures in conjunction with terrestrial networks. On the other hand, unresolved issues remain in developing a broadband satellite transponder, HDR MODEM, error correction CODEC, and networking protocols. To promote the development of such kinds of technologies, an HDR transmission experiment using ETS-VI is planned. In addition, a transpacific demonstration experiment using ACTS and Intelsat is proposed. Also proposed is the concept of the Advanced Asia Pacific Telecommunications Satellite System. The satellite-based HDR systems will provide flexibility of network configuration and services, and a cost effective way of constructing an information infrastructure.

CRUSTAL DEFORMATION OBSERVATION BY SPACE TECHNIQUES —TOWARD THE EARTHQUAKE PREDICTION IN THE TOKYO METROPOLITAN AREA—

Kosuke HEKI

Seismic activity in the Tokyo metropolitan area has been unusually quiet since the great Kanto earthquake in 1923. It is, however, expected to get more active in the coming several tens of years from geophysical and historical viewpoints. Both the population and the political/economic activities in Japan heavily concentrate there and future earthquake damages in this region will obviously influence the whole country. Earthquake prediction is not only the subject of public demand but also one of the ultimate goals of geophysics. However, there is not even an agreement among geophysicists whether earthquakes are predictable in principle or not. This is coming from the shortness of the observing history of earthquake precursors and thereby the incompleteness of the theory describing how earthquakes start. It would therefore be essentially important to densify and improve the observing networks currently deployed in Japan to accelerate the progress of the earthquake prediction studies. Crustal deformation is one of the most fundamental items to be observed for both long- and short-term earthquake predictions. Space techniques, such as Global Positioning System (GPS), Satellite Laser Ranging (SLR) and Very Long Baseline Interferometry (VLBI), are now widely used in crustal deformation studies. In this article I review what kind of new roles they are expected to play in the future earthquake prediction program in this country.