

Listed are abstracts from recent papers by IBM authors. Inquiries should be directed to the publications cited.

Abstracts

Computer-assisted fingerprint encoding and classification, C. N. Liu and G. L. Shelton, Jr., *IEEE Transactions on Man-Machine Systems* **MMS-11**, No. 3, 156-160 (September 1970). A proposed man-machine system for encoding fingerprint ridge characteristics is described. The fundamental concept underlying the proposed system is to use an operator to recognize the ridge characteristics and to impart to a computer the ability to manipulate and compare the digitized locations and directions of these characteristics for single-fingerprint classification. The proposed system and encoding schemes were simulated using a RAND tablet and an IBM 1800 computer. Sample input prints were encoded and stored on a magnetic tape. Experimental results on human factors and multiple-impression file searches illustrate the feasibility of computer-assisted fingerprint encoding and classification.

Delta modulation, H. R. Schindler, *IEEE Spectrum* **7**, No. 10, 69-78 (October 1970). The idea of coding the human voice into digital pulses was conceived more than three decades ago; exploitation had to await the ushering in of the transistor era. Since then, coding systems gradually have improved. One of the latest and most efficient schemes is delta modulation. Compared with earlier analog-to-digital-pulse conversion systems, an increase in the voice-handling capacity of telephone equipment by a factor of two or more has been made possible. At the same time, equipment requirements have become less stringent.

High-speed computer multiplication using a multiple-bit decoding algorithm, H. Ling, *IEEE Transactions on Computers* **C-19**, No. 8, 706-709 (August 1970). This paper presents a method of performing the binary multiplication beyond the scheme of multiple ADD and SHIFT. The binary multiplication algorithm is discussed first, followed by block decoding method, logic implementation, hardware consideration, and two examples which are at the end of the discussion.

Optimal starting approximations for generating square root for slow or no divide, *Communications of the ACM* **13**, No. 9, 559-560 (September 1970). On machines with slow or no division, it is preferable to use an iterative scheme for the square root different from the classical Heron scheme. The problem of optimal initial approximants is considered, and some optimal polynomial initial approximations are tabulated.

The reconstruction of binary patterns from their projections, S. K. Chang, *Communications of the ACM* **14**, No. 1, 21-25 (January 1971). Given the horizontal and vertical projections of a finite binary pattern f , can we reconstruct the original pattern f ? In this paper we give a characterization of patterns that are reconstructable from their projections. Three algorithms are developed to reconstruct both unambiguous and ambiguous patterns. It is shown that an unambiguous pattern can be perfectly reconstructed in time $m \times n$ and that a pattern similar to an ambiguous pattern can also be constructed in time $m \times n$, where m, n are dimensions of the pattern frame.

Signed-digit division using combinational arithmetic nets, C. Tung, *IEEE Transactions on Computers* **C-19**, No. 8, 746-748 (August 1970). To meet the challenge created by the advent of large-scale integration, a unique microelectronic arithmetic building element and combinational arithmetic nets, composed of the building elements, have been studied and proposed for arithmetic processor design. A fast division algorithm, particularly suitable for floating-point arithmetic, has also been developed for signed-digit arithmetic. This algorithm is characterized by the need of preprocessing the divisor and then exact generation of quotient digits. This paper describes the implementation of this division algorithm with the arithmetic building element and combinational arithmetic nets. The intention here is to explore the feasibility of applying large-scale integration technology to arithmetic processors.

A statistical mechanical approach to systems analysis, A. E. Ferdinand, *IBM Journal of Research and Development* **14**, No. 5, 539-547 (September 1970). The maximum entropy principle is used as the criterion for calculating the equilibrium state probabilities of a queuing or network system in which service rates are exponentially distributed. A configuration-independent partition function is given as the solution to this network problem; from this function the important properties of the system may be derived. Simple and well-known examples are used to illustrate the method. A phenomenon similar to the phase transition of statistical mechanics is observed in a queuing model.

Erratum

In the paper "Compiler assignment of data items to registers" by W. H. E. Day in Volume 9, Number 4 (1970), Equation 7 on page 294 should read

$$Q = \{q_i \mid n_{q_i} \in N', (r_{q_i} \leq r_{q_j}) \Rightarrow (i < j)\} \quad (7)$$