Preface: Mechanical Technology

This issue of the Journal is devoted entirely to mechanical technology, in recognition of an engineering discipline that plays a large and growing role in the development of business machines. We have selected papers that we believe are representative of the variety of work now being done by IBM, and have emphasized methods and results that have potential application beyond the specific problems from which they derive. The following topics are included:

Materials The paper by Chen and Flavin discusses the mechanics of film adhesion, and gives an analysis of the behavior of film in peeling from a rigid substrate. Baumann, in his paper, describes a linearized mathematical model that has proved useful in predicting the viscoelastic behavior of computer tape subjected to periodic motion in the operating environment.

Mechanical analysis and design To provide dynamic control of spring-driven devices, Bishop and Wilson have developed a method for controlling both velocity and deceleration by means of a single pneumatic cylinder. Their paper describes both the general theory and its application to a spring-driven paper-cutting mechanism. Beaty, Hoskins, Richards and Simpson report on the design, simulation, implementation and testing of a mechanical document-scanning system. Zable and Yarrington discuss the general problem of optimizing throughput in a document sorter. They have analyzed the selector mechanism of a sorter and present both analytical and graphical methods for optimizing response time. A communication by Patlach describes the mechanical design of a rotating disk system for use in a cryogenic magneto-optic memory.

Instrumentation and measurement In the general field of instrumentation, optic and acoustic methods are becoming increasingly prominent. For situations in which it is possible to use them, these methods are less likely than other techniques to disturb the object being measured and often have greater precision. Also, of course, the need is increasing for instruments to monitor and control the optic and acoustic phenomena themselves. Peterson, Ackerman and Zelenski discuss the use of a hybrid (analog-digital) system that can analyze the acoustic output of complex mechanical equipment and identify individual noise sources. Holographic interferometry, which became practical only recently, has been used by Wilson and Strope to study printer type-piece deformation; they report some particular twisting effects that were not previously known. The older method of white-light interferometry has been brought to a new application; Lin and Sullivan have used it, in conjunction with transparent mechanical elements, to measure the dynamic thickness of the air film between a slider and a rotating disk. They report a resolution, for thicknesses of less than a micron, which surpasses that of monochromatic techniques. The final paper on instrumentation is a communication by Crispi, Maling and Rzant, which describes the use of both acoustic and optical monitoring equipment in an ultrasonic bonding application.

Heat transfer and thermodynamics Most current methods for calculating steady-state temperature distribution by numerical computation fail at certain magnitudes of the nonlinear term when radiation is present in the system being analyzed. White, however, reports a Gauss-Seidel relaxation technique which, when combined with a Newton-Raphson method of root evaluation, produces monotonic convergence over the entire range in cases that have been tested. Randolph and King have analyzed some complex heat transfer surfaces that take advantage of the economy and simplicity of superplastic thermoforming; heat transfer and flow friction data are presented for several tested patterns. In two papers on the thermal characterization of electronic components, applications are discussed at both the chip and module levels. Paivanas describes a model for predicting the steady-state temperature distribution in plastic-encapsulated modules for which experimental methods have so far proved unworkable, and Lindsted and DiCicco have studied the steady-state temperature rise in integrated circuit chips. In the latter paper, data from specially constructed test devices confirm the results from the model.

The editors are indebted to C. C. Wilson of the Office Products Division in Lexington for his early initiative and encouragement in this project, and to R. S. Aubu-Zayyad of the Systems Development Division in San Jose, T. C. Brinkman of the General Systems Division in Rochester, and R. E. Norwood of the Systems Development Division in Boulder for serving as voluntary consultants.

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