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COVER Even systems as simple as a periodically forced damped pendulum can have complex behavior. This computer-generated plot shows initial pendulum velocities (measured horizontally) and positions (measured vertically). Orbits starting at points in the red region eventually settle into one type of periodic motion, while orbits starting in the blue region yield a different type of periodic motion. The boundary between these regions is fractal. The lighter the shade of red or blue, the longer it takes to settle into the corresponding motion. See page 632. [Photo courtesy of C. Grebogi, E. Ott, and J. A. Yorke, University of Maryland, College Park, MD 20742]

Reports

Book Reviews

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Brittle Books and Journals

One of the stimuli for scholarly publication is the belief by scientists and other authors that their work will add enduring values to the human heritage. But, as librarians have known for decades, most books and journals are perishable. Efforts to minimize degradation and its consequences will require the cooperation of scientists and engineers with librarians, archivists, and others.

The extent of the problem is typified by an inventory of the 13.5 million volumes at the Library of Congress. Of these, 3 million are too brittle to handle, and each year about 70,000 more volumes are added to this group. Science and technology represent 25 percent of the class collections of the Library of Congress.

The major source of the degradation is a defect in the manufacture of most paper. To prevent running of the printing ink on the paper, a sizing or filler is used that has an acid reaction. The sizing is a combination of alum and resin that results in a *p*H of about 4.8. Paper contains adsorbed water to the extent of 4 to 6 percent of the weight of the cellulose. The hydrogen ions catalyze hydrolysis of the cellulose, destroying its strength and suppleness. When the *p*H is 7 or slightly above, paper can remain strong and supple for many hundreds of years. Satisfactory paper need not be acid. A sizing containing magnesium or calcium carbonate maintains the *p*H at a safe level. Cost of such paper is about the same as the acid type. Problems of future degradation would be lessened if editors and publishers insisted on the use of acid-free paper.

It seems likely that practical processes will be capable of halting degradation of existing acidic books. One process, which has been tested in a pilot plant, involves neutralization of the acid and incorporation of an alkaline reserve into the pages of the books and journals. In a full-scale plant, now under construction, 7500 to 9000 volumes will be loaded into a tank capable of sustaining a high vacuum. When the vacuum is established, most of the water in the books (on the order of 50 gallons or more) will be pumped out, reducing the content in the books to 1 percent or less. A volatile compound, diethyl zinc, will then be introduced. It will diffuse into the volumes, neutralize any acid present, and react with moisture to form zinc oxide, which is mildly alkaline. Subsequently, excess diethyl zinc will be removed, and the books rehydrated. The total process will be complete in 3 to 5 days, with a cost per volume estimated at about $3. The process leaves no odor or toxic substances and does not affect the ink or the binding. However, the process must be conducted carefully; diethyl zinc bursts into flame when exposed to air.

The big problem for libraries is what to do about the books that have become brittle. The pages of the volumes can be photographed, resulting in master copies of microfilm or microfiche. However, costs per volume range up to $100. For the collection at the Library of Congress, the expenditures needed to save 3 million volumes have been estimated at $258 million. The Library of Congress has our greatest collection, but other institutions have many items not catalogued there. To avoid unnecessary costs and duplication, it will be desirable to have a nationwide accessible bibliographic data file. In addition, in science and technology, some books and journals are far more valuable than others. Priorities need to be established. A useful model is that used at the National Library of Medicine, where committees of physicians, scientists, and librarians have selected the most important literature for inclusion in the library's bibliographic system. In consequence, the biomedical literature is well provided for. The National Agricultural Library will probably serve the needs of agriculture. However, much of the remainder of science and technology is not specifically covered. The Library of Congress will need cooperation in its selection of scientific and technical literature. Another focal point for preservation activities is a newly created Commission on Preservation and Access formed under the sponsorship of the Council on Library Resources located in Washington, DC.

Ultimately, much of the scientific literature will be available in machine-readable and searchable form. But that is some time away, and most scientists will wish to retain the convenience of hard copies of journals.—PHILIP H. ABELSON