

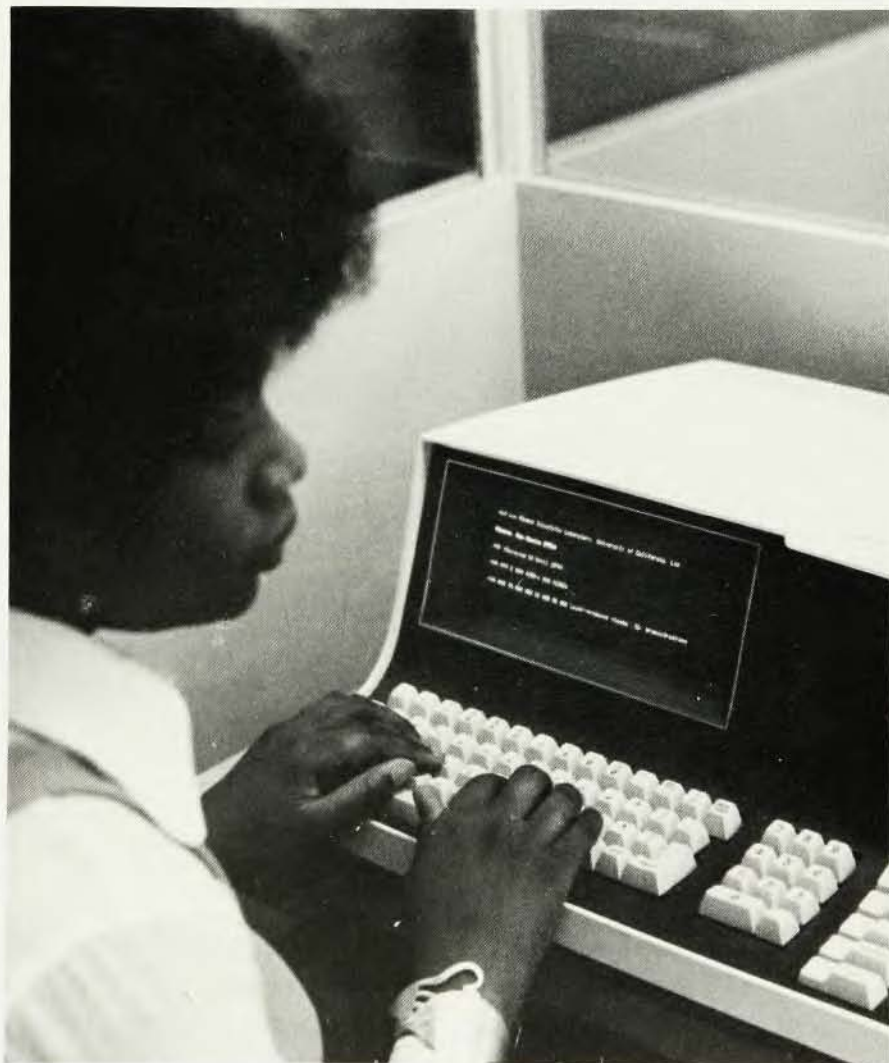
Microcomputers reduce student boredom in math

J. M. Anthony Danby

In the recent correspondence on microcomputers in physics (July, page 13), one area seems to me to have been neglected: that the microcomputer can free the student from some of the stultifying aspects of our traditional syllabus, and open up a new world of experimentation.

As an illustration, consider the traditional introductory course in differential equations offered to sophomores. This is likely to be listed in a syllabus as "Applied Differential Equations" or "Differential Equations with Applications." But most of the "applications" are so banal and limited that many intelligent students wonder why they should bother with them, or with differential equations, at all. I have seen this happen too many times. But suppose that the students can have the experience of applying differential equations to nontrivial problems of interest to them. They may then be more patient and show greater interest in acquiring the formal mathematical background—they may even want to learn more.

For several semesters, we have offered at North Carolina State University a sort of "lab" supplement to our introductory course in differential equations, carrying credit of one hour. After a student has learned to understand and control an efficient method for numerically solving a system of equations—we use Fehlberg's RK4(5) method with step-size control, an essential feature—he or she has a choice of projects in several areas, a lot of them in physics. Many students are fascinated by orbits in space. They can, without difficulty, design an orbit from the Earth to the Moon (without the two-body approximation), follow the last few revolutions of Skylab (this is one of the favorite projects), see Jupiter 'capture' a parabolic comet or accelerate a spacecraft. They can observe the interchange of energies in the rolling and pitching of a ship, or see how the



vertically upward equilibrium of a pendulum can be made stable, and so on. In general, they can enjoy the effects of nonlinearity without approximation, and they can change parameters freely, observing results on qualitative conditions such as stability.

This course has been quite successful. One of the problems that we have had is that, for most computing, the students have to learn to use the university's central computing system, which can be intimidating: the learn-

ing frustrations can be terminal and take up precious time. The system has no graphics capability within it, and gaining access to additional plotting facilities involves still more time and hassle. The students who own microcomputers have an advantage; and very soon, we hope, every student will own or have access to a friendly microcomputer with graphics. Surely we need to look for more ways of using this new freedom to improve instruction and learning. □

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