## CONVERSING IN CITRAN

A new computer language designed specifically to be easy to learn and to allow direct conversations with the machine has been developed at Caltech by Stephen H. Caine, head of programming systems at Booth Computing Center, and Richard H. Bigelow, graduate student in engineering science.

The new system, named CITRAN (a combination of the initials of California Institute of Technology and the first four letters of the word *translator*), has proved to be remarkably successful in both of these objectives. Caltech students have been able to learn CITRAN and put it to work on the computer desk consoles in about *one-tenth* the time it took under the previous system. Within two hours they are able to read the 36-page instructional manual and to begin using the computer system.

CITRAN was first introduced last fall to freshmen in their physics and chemistry laboratory courses. Students have the use of 25 desk console computers, 15 of which are in laboratories throughout the campus and 10 in the computing center. All 25 are hooked up to an IBM system/360 Model 50 computer and can be used simultaneously.

CITRAN users can communicate with the computer on the spot and are therefore able to immediately correct any error in the direction of their programming. The more complicated, classical methods require a complete specification of the problem to be punched on cards before it can be submitted to the computer. The problem must then await its turn among many others to be fed to the computer. Much later the user may discover that a single inconsistent detail makes necessary a complete revision of his programming.

Taking the general idea of JOSS, a system developed recently at RAND Corp. of Santa Monica, CITRAN's innovators worked out the new language in six months, with the support of National Science Foundation funds and International Business Machines, Inc., equipment.

The computer console keyboard used under the CITRAN system resembles a standard electric typewriter in letter and figure placement. The language includes such commonly recognizable symbols as – for *subtract* and = for *equals*. Special symbols and abbreviations are used, such as an asterisk for *multiply* and *SQRT* for square root. If a student wishes to ask the computer to solve the problem—What is x times x and the square roots of x, if x equals 6, 11, 27, or 30?—he types: Type x*x, SQRT (x) FOR x = 6, 11, 27, 30. Less than a second after the order is typed the computer takes control of the console and produces the answers in neat form.

If the student omits something in his procedure, the computer interrupts him with a message such as *unrecognized name* or *x is undefined.* If he reaches a point where he doesn't know what to do next, he writes *HELP.* According to the CITRAN manual, *HELP* is recognized by the computer and will be given. "The type of help will vary from case to case," says the manual, "but will always be self-explanatory." Actually, all the computer now advises is for the student to see a consultant at the computing center. However, the CITRAN developers say they will eventually have the computer advising the students directly.

Novice students are not the only people using CITRAN. Graduate students, researchers, and faculty have found it a convenient system. With it they can test the correctness of an isolated part of a more complicated program before they proceed to set up for more time-consuming systems, such as FORTRAN. The great advantages of the use of the new language are the simplicity of the programming and the immediate adjustment of the programming it allows.

*Richard Bigelow and Stephen Caine, developers of the new computer language being used at Caltech.*

*Caltech researchers conduct earthquake simulating tests from the ninth floor of Millikan Library.*

EARTHQUAKE ENGINEERING RESEARCH

Vibrations generated by two shaking machines being used to study the dynamic properties of Caltech's new Millikan Library not only shook the library in recent tests, but shook the ground throughout the entire Pasadena area and were detected by a seismograph more than eight miles away at Mount Wilson. The tremors produced by the two, ½-horsepower vibration generators installed on the ninth floor of the unfinished building were part of a series of earthquake simulating tests conducted by Caltech graduate student Julio Kuroiwa. The test shaking, done under the supervision of Paul C. Jennings, assistant professor of applied mechanics, is also part of the Institute's research program in earthquake engineering.

When the instruments at Caltech's Seismological Laboratory more than three miles away first began to record the unusual ground motion, the engineers there did not know their source. Clarence Allen, interim director of the laboratory, who knew that the building tests were being conducted, suggested they were probably responsible. To verify this, Dr. Jennings and Kuroiwa turned the shaking machines on and off, producing a "coded earthquake." The signals were clearly recorded by the seismological laboratory instruments.

Waves generated by natural earthquakes are often used to study the nature of the earth's interior. The intensities and velocities of the waves are altered by different geologic formations. By studying these changes in the waves, geologists can learn something about the material through which the waves pass. Dr. Allen and Ronald F. Scott, Caltech associate professor of civil engineering, decided to take advantage of the artificially induced earthquake waves to obtain information about the ground in the Pasadena area.

On December 18 Dr. Allen and seismological engineer Francis Lehner set up five portable seismometers at specific locations in Pasadena and Altadena. While Dr. Jennings and Kuroiwa operated the shaking machines, Lehner and Drs. Allen and Scott took readings on the seismometers. The tests were made between the hours of 11 p.m. and 3:30 a.m. when the ground was the least likely to be disturbed by vibrations from traffic and other sources. A sixth portable instrument was moved around to a dozen different locations during the four-hour period, and readings were taken on it at various distances from the library to determine the effects of distance and local geology on the ground motion.

Later it was discovered that the shaking had also been recorded at the permanent Caltech seismograph station on Mount Wilson.

"We didn't expect to detect the waves as far away as that," says Dr. Jennings. "It appears that shaking a multi-story building is a good way to get energy into the ground, and this method may lead to improved techniques for studying the effects of local geology upon earthquake motions."

In the tests of the building, which were done to determine how it would behave during an earthquake, the shaking was north-south, east-west, and torsional. The strongest ground shaking was produced when the building was vibrating north-south, because it is more rigid in that direction.

Ground shaking could be felt in the immediate vicinity of the structure but not by anyone standing more than a few feet away. It is estimated that the top of the building, which oscillated a maximum of about 0.1 inch, shook with about ten percent of the intensity that would be felt during a strong earthquake. No damage was expected during the tests, and none was observed.