Virtual Laboratory for Computer Graphics and Machine Vision

Yuri Bayakovsky

Moscow Stale University, Russia
yurib@gin.keldysh.ru

Experience of teaching computer graphics courses in Moscow State University is analyzed. Two aspects - evolution of curriculum in time and curriculum in time – dependence of approachers and techniques upon level of education - are considered.

Evolution: Formation and Development of CG education in MSU

There are some cultural features that strongly influenced the formation and development of computer graphics education in this country. Perhaps the most important feature is that education and basic research are separated. The university system is oriented to education, and institutes of Russian Academy of Sciences (RAS) oriented mostly toward research. However, the separation is not absolute. Some research projects are conducted in universities and post-MS education is available in institutes of RAS. Moreover, scientists from RAS are often part-time professors in universities. More details can be found in [I].

The first developments in CG date back to the second half of the 1960's. They began in institutes of RAS (Moscow, Novosibirsk) in order to provide facilities to visualize results of scientific computations. By the middle of the 1970's, several doctoral dissertations had been defended. Since then, computer graphics had been recognized as an educational subject. In the middle of the 1970's several students in MSU defended their diploma works in CG and graduated as CG majors. By the way. the first diploma work on the theme related to CG was defended in 1968.

Introductory course on CG has been given regularly since 1983. At the first time it was two-semester elective for 20-30 students of Computer Science Department pursuing advanced work in the field. Later (since 1990), one-semester course has become required for computer science majors (about 150 third year students), and finally (since 1994) it is required for all (about 300) second year students of CS Dept. (including mathematicians).

Education in universities takes five years (six years in the engineering disciplines), and it is concluded by defending of diploma work or a project (like a master thesis). There is no an intermediate degree like B.Sc., B.Eng. Post-MS education takes three years, and it is completed by defending a candidate dissertation (like a doctoral thesis).

There are three stages in undergraduate university education: basic disciplines for the first two years, then specialization within a selected chair for two years, and finally one year for completing research and writing a thesis. After choosing a specialization, a student chooses an advisor who defines topics for term projects and theme for the master's thesis.

Approaches and Technologies: Dependence on Level of Education

CG curriculum embraces all levels of education: undergraduate, graduate, and post-graduate. Every level raises its own problems and concerns.

***Undergraduate** level.* The main concern is the content and methodology for leaching the introductory computer graphics course. There are widely different viewpoints [2]. We follow the idea, that this course should be useful to general CS students because many applications will need to add graphical content in the future [3]. In our case, the course is given for more than 300 students, and most of them will not pursue advanced work in the field. Because of this two topics are emphasized:

1. Image and image manipulation
2. OpenGL as a tool and basic principles and concepts this library is based on [4].

This way the convergence of CG and imaging is taken into account [5].

Other serious problems are course delivery and communication between teaching team and more than a hundred students. Combining computer technologies with distance leaning is an adequate solution for this level.

***Graduate** level.* These courses are intended to students who want to pursue advanced work in the field. Curriculum of this level is project oriented. Embedded in this process, students experience the core competencies of teamwork, problem solving, communication, and innovation. A framework should be provided that guides the team project through the project. Several information technologies recently developed - Virtual Laboratory, Digital Library, and others – solve this problem.

Post-graduate level. The main purpose is a real experience in the production process and involvement in real world projects. "Professors and graduate students sometimes have only a partial understanding of the complex process of turning a research prototype into a product. By fully understanding the product development cycle, academicians will gain a more realistic view of their roles in the process." [6] Virtual laboratory is quite helpful facility in this case.

Acknowledgement

This work is partially supported by Russian Foundation for Basic Research (grant 98-01-00545) and Intel Corp.

References

1. Y. Bayakovsky "Russia: Computer Graphics Education Takes Off in the 1990s" Computer Graphics, 30(3), Aug. 1996, pp. 21-22.
2. R. Wolfe "A Syllabus Survey: Examining the State of Current Practice in Introductory Computer Graphics Courses" Computer Graphics, Feb. 1999.
3. S. Cunningham "An Evolving Approach to CG Courses in CS" GraphiCon'98, Conference Proceedings, MSU, Sept. 1998.
4. R. Wolfe "Open GL: Agent of Change or Sign of the times" Computer Graphics, Nov. 1998.
5. J. Foley "The Convergence of Graphic and Imaging" Eurographics'98, CGF, 17, 1998.
6. J. Foley "Technology Transfer from University to Industrv" CACM, 39(9), Sept. 1996.