

Narrative Statement for John R. Rice, July 16, 1999

During the period of 1960 to 1990 Rice was a leading contributor to the field of approximation theory. He wrote numerous papers and books, his principal innovations were in being the first to systematically develop nonlinear approximation theory and methods. He was the first to discover how to identify best spline (piecewise polynomial) approximations and he developed both the theory and practice of adaptive approximation where one adjusts the breakpoints of splines to achieve the best possible approximation. He laid the foundation for the adaptive methods that have since revolutionized computational geometry (e.g., CAD systems) and solving partial differential equations (e.g., adaptive mesh refinement).

Rice founded the field of mathematical software with a workshop in 1970. He organized two more workshops in the 1970s and founded the ACM Transaction on Mathematical Software in 1975. Among the innovations he introduced were the systematic evaluation of math software, a theoretical framework for such studies, and computer systems to facilitate them. Another was the concept of mathematical software parts as a logical extension of the program library idea. This work around 1980 was a precursor to the object oriented methodologies that now permeate software development.

The concept of problem solving environment originated in the 1960s and Rice made the most ambitious attempt with his Numerical Analysis Problem Solving System. These ideas faded quickly when it was realized that the available computing power could not support such software systems. He revived the effort in the early 1980s and in 1989 organized an exploratory workshop that launched this emerging software technology. It now has several conferences per year and is the subject of a series of government research funding competitions. Rice has implemented the most advanced examples of this revolutionary approach to providing scientists with computing power.

Finally, Rice has made a long series of important contributions to scientific computing, such as methods for solving partial differential equations or using parallel computers. The most innovative of these are in the area of higher order methods; he recently conjectured that all real world partial differential equations can be solved using such methods just as fast as evaluating closed form solutions (he has proved a number of instances of this general conjecture). His other recent innovation is the development of concrete methodologies for incorporating computational intelligence into scientific software. These ideas were present in his 1960s and 1970s work and now the methodologies of learning (from artificial intelligence) have matured enough so that this new kind of computational support can be provided to the working scientist.

Proposed Citation

For seminal contributions to nonlinear approximation theory and scientific computing and for initiating the fields of mathematical software and problem solving environments.