2005 Board of Trustees' Award for Outstanding Research and Creative Scholarship Recipient

Professor Homer Walker

Over the past three decades, Homer Walker has established himself as a world leader in the numerical solution of large nonlinear systems of equations. His highly influential work covers Newton methods, inexact Newton methods, and Newton-Krylov methods. He has made foundational contributions in the convergence theory of inexact Newton methods, the robust and efficient numerical implementation of these methods, and the development of related computational software.

Professor Walker has pioneered in a number of major developments over the years. His papers with J. E. Dennis in the 1980s were the first to explain the success of quasi-Newton methods applied to the solution of nonlinear systems. They led to an explosion of work on these methods that persisted for over 10 years. Dennis gives Walker primary credit for this breakthrough. As he writes, "I feel that I contributed to the final forms of the proofs but Homer is the originator. It was his idea to use the projections in the proofs and his expertise accomplished it."

In the 1990s computational mathematics research moved to the analysis and implementation of Newton-Krylov methods and as a professor from a major research university states "Homer was a leader in this transition." His main contributions are related to the Generalized Minimal Residual (GMRES) method introduced in the late 1980s. GMRES is today perhaps among the most widely used methods for the solution of large systems. While visiting Yale, Professor Walker collaborated with Stanley Eisenstat to develop the Eisenstat-Walker criterion, one of the most influential root-finding strategies for the large-scale solution of implicit partial differential equations since the Armijo conditions. This criterion has been implemented in important codes such as the KINSOL at Lawrence Livermore National Laboratory and the PETSc at Argonne Laboratory that have been downloaded by computational scientists and engineers around the globe.

Professor Walker's 10-year collaboration with Sandia National Laboratories has helped develop the new NOX (nonlinear solutions methods package). A leading scientist at Sandia states that "Homer's work has had a profound influence at Sandia. NOX is critical to our own infrastructure and also is positioned to become one of the premier numerical solution libraries in this important area." The methods and software that implement these techniques have already been applied to complex problems in chemically reacting flow, electric circuit analysis, semiconductor device simulations, compressible aerodynamic, free-surface flows and magneto-hydrodynamics.

Professor Walker is highly regarded in the US academic research community, the international numerical methods community, and the national laboratory community. Professor Walker's research has received extensive support from the National Science Foundation, NASA, Department of Energy, Air Force Office of Scientific Research as well as the Sandia and Lawrence Livermore National Laboratories. He is one of the top 240 most cited mathematicians in the world. As a prominent scientist writes "WPI has many feathers in its cap, but it would be hard to imagine that it harbors many scientists who have exerted a stronger practical influence than Homer." Professor Walker's contributions, however, go beyond his own research. Colleagues call him a "tireless and fair reviewer" and "a patient and gifted pedagogue."

In recognition of his many significant contributions to the field of Computational and Applied Mathematics, it is with great pride that Homer Walker is named the recipient of the 2005 Board of Trustees' Award for Outstanding Research and Creative Scholarship.