

**President's Distinguished Lecture Series
Texas Tech University**

***"Inverse, Shifted Inverse, and Rayleigh Quotient
Iteration as Newton's Method"***

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Abstract

Normalized inverse iteration, shifted inverse iteration, and Raleigh quotient iteration (RQI) are well known algorithms for computing an eigenvector of a symmetric matrix. In this study, we demonstrate that each of these algorithms can be viewed as a standard form of Newton's method from the nonlinear programming literature, followed by the normalization. This provides an explanation for the good behavior of RQI despite the need to solve systems with nearly singular coefficient matrices; the singularity can be viewed as essentially removable. Our equivalence result also leads us naturally to a new proof that Raleigh quotient iteration is cubically convergent with constant at worst 1. An interesting part of our study is the explanation as to why as normalized Newton's method inverse and shifted inverse iteration are only linearly convergent and not quadratically convergent and why RQI is cubically convergent and just quadratically convergent.

Bio

Dr. Tapia is internationally known for his research in the computational and mathematical sciences and is a national leader in education and outreach. His current Rice positions are University Professor (only the sixth individual afforded this title in the 100 year history of Rice University), Maxfield Oshman Professor in the Department of Computational and Applied Mathematics, and Director of the Center for Excellence and Equity in Education. Among his many honors, Richard Tapia was a 2010 awardee of the National Medal of Science, the highest honor bestowed by the United States government on scientists and engineers, and he was the first Hispanic elected to the National Academy of Engineering. In 1996, President Clinton appointed him to the National Science Board. From 2001 to 2004 he chaired the National Research Council's Board on Higher Education and the Workforce. He has received the National Science Foundation's inaugural Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring; and the Lifetime Mentor Award from the American Association for the Advancement of Science. He was also named one of 20 most influential leaders in minority math education by the National Research Council. This year Hispanic Business Magazine named Tapia one of the 100 most influential Latinos in the country. Two professional conferences have been named in his honor, recognizing his contributions to diversity: Richard Tapia Celebration of Diversity in Computing Conference and the Blackwell-Tapia Conference, whose founders described Tapia as a seminal figure who inspired a generation of African-American, Native American and Latino/Latina students to pursue careers in mathematics. Professor Tapia is recognized as a national leader in diversity.