



Generalized Cosine and Sine Functions

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The standard trigonometric cosine and sine functions may be defined either geometrically, in terms of the properties of a right-triangle, or as initial-value problems for the second-order, linear differential equation, $\frac{d^2x}{dt^2} + x = 0$. The main purpose of this presentation is to demonstrate that there exist generalizations of the cosine/sine functions. Further, we obtain the important properties of these “classes” of periodic functions and show how an infinite number of such functions can be explicitly constructed. The possible application of these functions to the analysis of certain types of nonlinear dynamic systems will be given. An interesting aspect of these investigations is that in addition to the two generalized “cosine” and “sine” functions, there must always exist a third periodic function. We explain why this must be so.

Biography

Ronald Elbert Mickens was born and raised in Petersburg, VA. He received his BA degree in physics from Fisk University (1964) and a Ph.D. in theoretical physics from Vanderbilt University (1968). He held postdoctoral positions at the MIT Center for Theoretical Physics (1968-1970), Vanderbilt University (1980-1981), and the Joint Institute for Laboratory Astrophysics (1981-1982). He was professor of physics at Fisk University from 1970-1981. Presently, he is the Distinguished Fuller E. Callaway Professor at Clark Atlanta University. His current research interests include nonlinear oscillations, asymptotic methods for difference and differential equations, numerical integration of differential equations, the mathematical modeling of periodic diseases, and the history/sociology of African Americans in science. He has published more than 300 peer-reviewed scientific/mathematical research articles, and written and/or edited 15 books. He serves on editorial boards of several research journals, including the *Journal of Difference Equations and Applications* and the *International Journal of Evolution Equations*. His scholarly writings have appeared in reference works such as *African American Lives* (Oxford University Press), *American National Biography* (Oxford University Press), and *Biographical Encyclopedia of Scientists* (Marshall Cavendish). His honors include fellowships from the Ford, Woodrow Wilson, and National Science Foundations; and election to Phi Beta Kappa (1964). During 1998-1999, he was an American Physical Society Centennial speaker (as part of the activities to celebrate the 100th anniversary of the founding of the APS). He also served as a Distinguished National Lecturer for Sigma Xi, the Scientific Research Society for 2000-2002. He has received both the Francis G. Slack Medal and the Edward A. Bouchet Awards from the American Physical Society. His professional memberships include the American Association for the Advancement of Science, the American Physical Society (for which he is an elected Fellow), the History of Science Society, the Society for Mathematical Biology, and the American Mathematical Society.