1145-39-1405 **Ronald E. Mickens*** (rmickens@cau.edu), Clark Atlanta University, Atlanta, GA 30314, and **Talitha M. Washington** (talitha.washington@howard.edu), Howard University, Washington, DC 20059. *Bifurcations as the Genesis of Instabilities in the Numerical Solutions to Differential Equations.*

The discretization of differential equations by finite differences provides an important source of difference equations. However, the implementation often gives rise to numerical solutions having properties inconsistent with the expected mathematical properties of the solutions to the differential equations. These solutions are called "numerical instabilities (NI)." We demonstrate that the NI's are consequences of bifurcations related to the step-sizes which appear in the difference equations, but do not exist in the original differential equations. Further, we show how all the elementary NI's can be explicitly eliminated. This work extends the previous results of Mickens and his colleagues [1, 2, 3].

References

[1] B. F. Woods, Numerical Instabilities in Finite-Difference Models of Differential Equations, MS Thesis, Department of Mathematical Sciences, Atlanta University; Atlanta, GA. June 1, 1989.

[2] R. E. Mickens and A. Smith, "Finite-Difference Models of ODE's: Influence of Denominator Functions," Journal of the Franklin Institute, Vol. 327 (1990), 143–149.

[3] R. E. Mickens, "Global Dynamics and Bifurcation of Difference Equations," Abstracts of Papers Presented to the AMS (2014 Joint Mathematics Meetings; Baltimore, MD), Abstract 1096-39-772. (Received September 21, 2018)