

## **KNToosi MathTools: Series of Interactive Visualization Tools for Better Learning of Abstract Mathematical Concepts in Engineering**

*Abstract*— In this paper, a series of interactive Java-based visualization tools, named MathTools, are introduced. The idea of using visualization programs for abstract mathematical concept is explained. Twelve of such software are developed for differential equations and engineering mathematic courses, among them two of the software are explained in more details. The first one is a Java MathTool illuminates the behavior of second-order homogeneous linear differential equations and allows the students to see the effect of each parameter as a manipulative. The second is a visualization tool used for engineering mathematics course, is a visualization to illustrate different modes of a circular vibrating membrane. The results of primary student assessments show that, although the tools are not seen very effective in its current form, they gradually find their way among the students by using well-designed exercises.