Fuzzy Differential Equation
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Fuzzy differential equations is a branch of mathematics that extends the concept of traditional differential equations by incorporating fuzzy set theory. Fuzzy set theory makes it possible to describe the phenomena of uncertainty and inaccuracy involving vagueness and ambiguity. Fuzzy differential equations, involve fuzzy quantities and use fuzzy logic to deal with uncertainty in differential equations. The key idea is to represent unknown functions and parameters as fuzzy sets. The general form of the fuzzy differential equation is:

$F(x, y'(x), y(x), \mu) = 0$, where

- $y(x)$ is the unknown fuzzy function,
- $y'(x)$ is the fuzzy derivative of $y(x)$,
- x is the independent variable,
- μ represents the fuzzy parameters or initial conditions,
- F is a function that describes the relationship between x, $y'(x)$, $y(x)$ and μ.

Solving fuzzy differential equations involves finding fuzzy solutions that satisfy the equation under given fuzzy conditions. Various methods have been proposed for solving fuzzy differential equations, such as the extension principle, the fuzzy integral, and numerical techniques adapted to fuzzy information processing.

Fuzzy differential equations find application in business and management.

Application of the formula $y'(t) = -ky(t)$, where $k \geq 0$, $y(0) = Y0$, Y0 is a fuzzy triangular and trapezoidal function. The program solved the equation, and the outputs are displayed using two- and three-dimensional graphs, where the range of upper and lower limit values is clearly displayed.
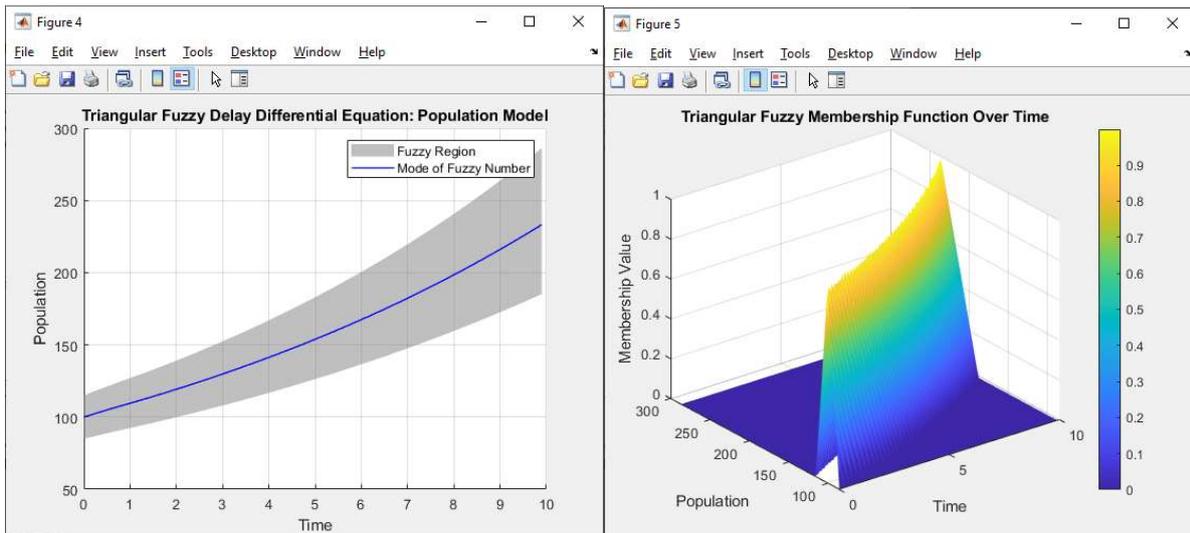

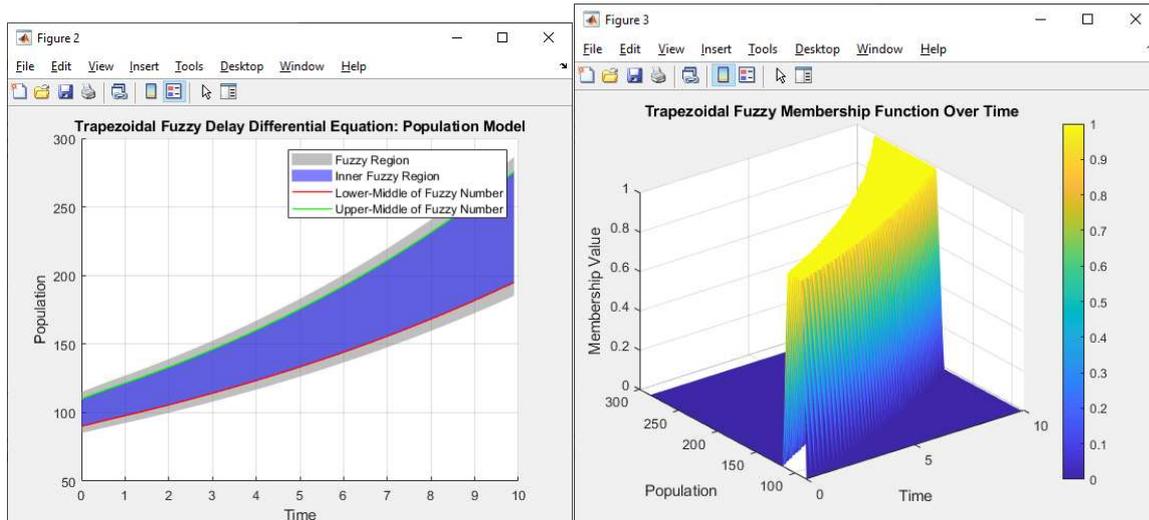**Fig.** Fuzzy differentials equations with triangular membership function

Fig. Fuzzy differentials equations with trapezoidal membership function

Literature: Tapaswini, S., Chakraverty, S., Behera, D. Fuzzy Differential Equations and Applications for Engineers and Scientists, 2016, ISBN 9781315372853.