ABSTRACT

SOLUTION OF FULLY FUZZY AND DUAL FULLY FUZZY NON LINEAR EQUATION SYSTEMS USING GENETIC ALGORITHM

By

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A system of non linear equations is a collection of several interrelated non-linear equations. Currently, non-linear equation systems are not only used on real numbers, but also fuzzy numbers. A fuzzy number is an ordered pair function that has a degree of membership [0,1]. Meanwhile, a fully fuzzy system of equations is a system of equations that applies fuzzy number arithmetic operations. The solution of non-linear equation systems is usually difficult to solve analytically, so numerical methods are used as an alternative to solve these problems. In this research, the steps to find the solution of non-linear fully fuzzy and dual fully fuzzy equation systems using genetic algorithms are studied, which in the solution process is based on the theory of evolution and natural selection. The solution steps taken are first converting the fully fuzzy system of equations into a system of strict equations, next constructing the system of strict equations as a multi-objective optimization problem, and lastly solving the optimization problem using a genetic algorithm which includes initialization, evaluation, selection, crossover, and mutation. As an illustration, several cases of non-linear fully fuzzy and dual fully fuzzy systems of equations on triangular fuzzy numbers and trapezoidal fuzzy numbers are given. The approximate solutions obtained using genetic algorithms produce solutions that are close to their analytic solutions.

Keywords : Non linear fully fuzzy and dual fully fuzzy systems of equations, genetic algorithm, triangular fuzzy numbers, trapezoidal fuzzy numbers.

ABSTRAK

**SOLUSI SISTEM PERSAMAAN *FULLY FUZZY*
DAN DUAL *FULLY FUZZY* NON LINEAR
MENGGUNAKAN ALGORITMA GENETIKA**

Oleh

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Sistem persamaan non linear adalah kumpulan dari beberapa persamaan non linear yang saling berkaitan. Saat ini sistem persamaan non linear tidak hanya digunakan pada bilangan *real* saja, tetapi juga bilangan *fuzzy*. Bilangan *fuzzy* adalah suatu fungsi pasangan terurut yang memiliki derajat keanggotaan [0,1]. Sedangkan sistem persamaan *fully fuzzy* adalah sistem persamaan yang menerapkan operasi aritmatika bilangan *fuzzy*. Solusi sistem persamaan non linear biasanya sulit diselesaikan secara analitik, maka dari itu metode numerik digunakan sebagai alternatif untuk menyelesaikan permasalahan tersebut. Pada penelitian ini dikaji langkah-langkah pencarian solusi sistem persamaan *fully fuzzy* dan dual *fully fuzzy* non linear menggunakan algoritma genetika yang mana dalam proses penyelesaiannya didasarkan pada teori evolusi dan seleksi alam. Langkah-langkah penyelesaian yang dilakukan yaitu pertama mengubah sistem persamaan *fully fuzzy* menjadi sistem persamaan tegas, selanjutnya kontruksi sistem persamaan tegas sebagai masalah optimasi multi-objektif, dan terakhir selesaikan masalah optimasi tersebut menggunakan algoritma genitika yang meliputi inisialisasi, evalusai, seleksi, *crossover*, dan mutasi. Sebagai ilustrasi, diberikan beberapa contoh kasus sistem persamaan *fully fuzzy* dan dual *fully fuzzy* non linear pada bilangan *fuzzy* segitiga maupun bilangan *fuzzy* trapesium. Solusi hampiran yang diperoleh menggunakan algoritma genetika menghasilkan solusi yang mendekati solusi analitiknya.

Kata kunci : Sistem persamaan *fully fuzzy* dan dual *fully fuzzy* non linear, algoritma genetika, bilangan *fuzzy* segitiga, bilangan *fuzzy* trapesium.