

Table of Contents

1. INTRODUCTION	15
1.1. Introduction	15
1.2. Preliminaries:	17
1.2.1. Fuzzy Sets	17
1.2.2. Fuzzy Number	17
1.2.3. Fuzzy Number in parametric form	17
1.2.4. Fuzzy Triangular Number:	17
1.2.5. Fuzzy Arithmetic Operations:	18
1.2.6. Fuzzy Lipschitz:	18
1.2.7. Fuzzy continuity:	18
1.2.8. Fuzzy derivative:	18
1.3. Our Work	20
1.3.1. Analytical Method (Eigenvector and Eigenvalue):	21
1.3.2. Numerical techniques:	21
1.3.3. Fuzzy Laplace Transform	22
1.3.4. Semi-analytical Technique	25
1.4. Conclusion	28
2. PREY-PREDATOR MODEL WITH FUZZY INITIAL CONDITION	29
2.1. Introduction	29
2.2. Linearized Crisp Prey- Predator Model	30
2.3. Linearized Fuzzy Prey-Predator Model	31
2.4. Stability Analysis	32
2.5. Illustrative examples	33
2.6. Conclusion	39
3. NUMERICAL TECHNIQUES	40
3.1. Introduction	40
3.2. Numerical Scheme using the Hukuhara Difference	40
3.2.1. $\tilde{f}(t, \tilde{X})$ is linear function	41
3.2.2. Theorem	42
3.2.3. $\tilde{f}$ is nonlinear function	43
3.2.4. Theorem	43
3.3. Improved Euler Method	45
3.3.1. Lemma	46
3.3.2. Theorem	47
3.4. Application (Spread of Infectious Disease Model)	48
3.5. Conclusion	51

4. TRANSFORMATION TECHNIQUE.....	52
4.1. Introduction:.....	52
4.2. Fuzzy Nonhomogeneous Linear Dynamical Systems.....	52
4.2.1. Lemma	53
4.2.2. Lemma	53
4.2.3. Theorem	54
4.2.4. Real life example	56
4.3. Fully Fuzzy Semi-Linear Dynamical System:.....	58
4.3.1. Existence of Modified Hukuhara Derivative:	58
4.3.2. Example:	60
4.3.3. Fuzzy Laplace Transform under mH-derivative	61
4.3.4. Main Theorem	65
4.4. Example:	70
4.5. Conclusion	75
5. SEMI-ANALYTICAL TECHNIQUE.....	76
5.1. Introduction	76
5.2. Adomian Decomposition Method in a crisp environment (ADM):	76
5.2.1. Fuzzy Semi-linear dynamical system	77
5.2.2. Lemma	78
5.2.3. Fuzzy Adomian Decomposition Method in Parametric form (FADMP)	79
5.2.4. Theorem	80
5.2.5. Example	81
5.3. Fuzzy Adomian Decomposition Method (FADM) in fully fuzzy Environment	85
5.3.1. Decomposition theorem.....	85
5.3.2. Fuzzy function.....	86
5.3.3. Modified Generalized Hukuhara derivative:	87
5.3.4. Example 1:	88
Example 2:	88
5.3.5. Fuzzy power series and its convergence	89
5.3.6. Radius of Convergence	91
5.3.7. Lemma	92
5.3.8. Example	93
5.3.9. Example 1:	94
Example 2:	95
5.3.10. Fuzzy Taylor's theorem	96
5.4. Illustrative examples for Fuzzy Taylor series expansions of fuzzy functions	97
5.4.1. Fuzzy Taylor series for $e^{\tilde{x}}$	97
5.4.2. Fuzzy Taylor series for $\sin\tilde{x}$	98
5.4.3. Fuzzy Taylor series for $\cos\tilde{x}$	99
5.5. Fuzzy Adomian Decomposition Method.....	100
5.5.1. Convergence of FADM.....	102
5.5.2. Theorem	103

5.5.3.	Example	104
5.5.4.	Example	105
5.6.	Conclusion	107
6.	APPLICATION: MATHEMATICAL MODELLING OF AIR HEATING SOLAR COLLECTORS WITH FUZZY PARAMETERS	108
6.1.	Introduction	108
6.2.	Description of Problem	108
6.2.1.	Theorem	111
6.3.	Result and Discussion.....	114
6.4.	Conclusion	117

Bibliography

Our Work