# Generalized Monotone Method for Caputo Fractional Reaction-Diffusion Equation

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**Abstract:** *In this paper, our aim is to obtain the integral representation for the solution of non-linear Caputo reaction-diffusion equation of order q, where 0 < q < 1, in term of Green's function. We have developed a generalized monotone method for non-linear weakly coupled Caputo reaction-diffusion equation. The generalized monotone method yields monotone sequences which converges uniformly and monotonically to coupled minimal and maximal solutions. The existence of a unique solution for the non-linear Caputo reaction-diffusion equation is obtained.*

**Keywords:** Caputo Fractional Derivative; Eigen Function; Non-Linear Weakly Coupled System; Coupled Upper And Lower Solutions; Generalized Monotone Method

## REFERENCES

[1]. A.A.Kilbas, F.Mainardi and S.V.Rogosin Mittaf-Leffer Functions, Related Topic and Applications. Springer Monographs in Mathematics. 2014.

[2]. A.A.Kilbas and S. A. Marzan. Cauchy problem for differential equation with Caputo derivative. Fract. Calc. Appl. Anal.,7(3),(2004),297-321.

[3]. A.A.Kilbas, H.M.Srivastava and J.J.Trujillo. Theory and Applications of Frac- tional Differential Equations, Amsterdam, Elsevier, 2006.

[4]. Chhetri P.G. and Vatsala A.S. The Convergence of the Solutions of Caputo frac- tional Reaction-Diffusion Equations with Numerical Examples. Neural, Parallel and scientific computations. 25(2017),295-306.

[5]. Chhetri P.G. and Vatsala A.S. Generalized Monotone Method for Riemann- Li- ouville Fractional Reaction-Diffusion Equation with Applications Nonlinear Dy- namics and System theory. 18(3)(2018),259-272

[6]. Chhetri P.G. and Vatsala A.S. Existence of the solutions in Large for Caputo Fractional Reaction-Diffusion Equation by Picard's Method. Dynamics System and Application, 27(4)(2018),837-851

[7]. Denton Z. and Vatsala A.S. Monotone Iterative Technique For Finite System of Non- linear Riemann-Liouville Fractional Differential Equations. Opuscula Mathematica. 31(3)(2011),327-339.

[8]. Denton Z. Ng P.W.and Vatsala A.S. Quasilinearization Method Via Lower and Upper Solutions for Riemann-Liouville Fractional Differential Equations. Non- linear Dynamics and System Theory. 11(3)(2011),239-251.

[9]. Donna Stutson and Vatsala,A.S. A representations solution is obtained for the one dimentional Caputo fractional reaction-diffusion equation. Dynamic system and applictions 6(2012).

[10]. D.B. Dhaigude, J.A.Nanware and V.R.Nikam. Monotone Technique for Weakly Coupled System of Caputo Fractional Differential Equations with Periodic Boundary Conditions, Dyn.Contin.Discrete Impuls. Syst.Ser.A Math.Anal. 19(2012),575 - 584.

[11]. Jagdish A Nanware and Pandurang D Kundagr Generalized Monotone Method for System of Riemann-Liouville Fractional Reaction-Diffusion Equations, Com- munication in Nonlinear Analysis.(2021),1-20

[12]. J.A.Nanware and D.B. Dhaigude. Monotone Technique for Finite Weakly Cou- pled System of Caputo Fractional Differential Equations with Periodic Boundary Conditions, Dyn.Contin.Discrete Impuls.Syst. Ser.A Math.Anal. 22(1)(2015),13-23.

**[13].** J.A.Nanware and D.B. Dhaigude. Existence of Uniqueness of Solutions of Riemann- Liouville Fractional Differential Equations with Integral Bounadry Conditions.International Journal of Nonlinear Science. 14(4)(2012),410 - 415.

**[14].** J.A.Nanware and D.B. Dhaigude,System of initial value problems involving Riemann-Liouville sequential fractional derivative, Communications in Applied Analysis. 22(3)(2018),353-368.

**[15].** J.A.Nanware,N.B.Jadhav and D.B. Dhaigude,Monotone iterative technique for finite system of Riemann-Liouville fractional differential equations with integral boundary conditions, Proc.Internal.Conf.on Mathematical Sci- ences,India,2014,pp. 235- 238.

**[16].** J.A.Nanware,N.B.Jadhav and D.B. Dhaigude,Initial value problems for fractional differential equations involving Riemann-Liouville derivative, Malaya J. Mat. 5(2)(2017) 337-345.

**[17].** J.A.Nanware,N.B. Jadhav and D.B.Dhaigude,Existence and uniqueness of solu- tions of nonlinear implicit fractional differential equations, Dyn,Contin.Discrete Impuls.Syst.Ser.A: Math.Anal. 27(4)(2020) 275-282.

**[18].** Pao, C.V. Non-linear Parabolic and Elliptic Equations. Springer Science + Busi- ness Media, LLC,1992.

**[19].** Podlubny,I.Fractional Differential Equations.Academics Press. 198,San Diego,1999.

**[20].** Ramirez J.D. and Vatsala A.S. Generalized Monotone Iterative Technique for Caputo Fractional Differential Equations with Periodic Boundary Condi- tions via Initial Value Problem. International Journal of Differential Equations. 17(2012),842-843

**[21].** R.Hilfer. Applications of Fractional Calculus in Physics, World Scientific, Singa- pore, 2000.

**[22].** Sowmya M. and Vatsala A.S. Generalized Monotone Method for Caputo Frac- tional Differential Equations via Coupled Lower and Upper Solutions with Su- perlinear Convergence. Nonlinear Dynamics and System theory. 15(2)(2015),198- 208.

**[23].** V.Lakshmikantham S.Leela and D.J.Vasundhara Devi Theory of Fractional Dy- namic Systems. Cambridge Scientific Publishers,2009

**[24].** V.Lakshmikantham and A.S.Vatsala General Monotone Method For fractional Reaction-Diffusion Equations. Communications in Applied Analysis. 16(2012) 165-174.

**[25].** V.Lakshmikantham Theory of fractional functional differential equations, Non- linear Anal.69(2008),3337 - 3343.

**[26].** Vatsala A.S. and Donna Stutson. Generalized Monotone Method For Fractional Reaction-Diffusion Equation. Communications in Applied Analysis,16(2)(2012)165-174