REVIEW OF LITERATURE

1. **Atici,F.M (2007)** We begin with an introduction to a calculus of fractional finite differences. We extend the discrete Laplace transform to develop a discrete transform method. We define a family of finite fractional difference equations and employ the transform method to obtain solutions.

2. **Klimek,M AndDziembowski,D(2008)** The Mellin transform method is applied to fractional differential equations with a right-sided derivative and variable potential. After solving the intermediate difference equation we arrive at the general solution of the problem in the form of a Meijer-G function series. Using the symmetry properties of fractional derivatives we transform it into a general solution for an analogous equation with the left-sided Riemann-Liouville derivative. Two examples are studied in detail.

3. **Abbasbandy,S.E (2008)** In this paper, we propose a new type of fuzzy fractional differential equations under fuzzy Kolwankar-Gangal local fractional derivatives (for short, fuzzy KG-LFD) using fuzzy Riemann-Liouville differentiability. Then, we prove some basic results in this area like, the relation between different types of fuzzy KG-LFD and their r-cut representations, composition of the fuzzy KG-LFD and the fuzzy local fractional integral. Also, an application is provided in details such that the explicit solutions are expressed through Mittag-Leffler function.

4. **Ibrahim,R.W(2010)** In this paper we present the problem of global controllability (GC) of a set of fractional differential equation (SFDE).

5. **Garg,M AndChanchalani,L (2012)** In this paper, we obtain the solution of fractional q-kinetic equation, which involves the Riemann-Liouville fractional q-integral operator. We apply the method of q-Laplace transform and its inverse to obtain the solution in closed form. The solutions of ordinary q-kinetic equation and two more fractional q-kinetic equations are obtained as special cases of our main result. We have also drawn some graphs of the solutions of fractional q-kinetic equations using the software mathematica.

6. **Chouhan,A AndSaraswa,S (2012)** In this paper, we investigate the solution of a generalized fractional kinetic equation involving the generalized fractional integral
operator. The results are obtained by employing Laplace transform. Several special cases, involving generalized Mittag-Leffler function are also considered in the form of corollaries.

7. Zurigat, M (2012) This paper presents a numerical technique for solving fractional differential equations by employing the multi-step Laplace Adomian decomposition method (MLADM). The proposed scheme is only a simple modification of the Adomian decomposition method, in which it is treated as an algorithm in a sequence of small intervals (i.e. time step) for finding accurate approximate solutions to the corresponding problems. This method was applied in four examples to solve nonlinear fractional differential equations which were presented as fractional initial value problems. The fractional derivatives are described in the Caputo sense. Figurative comparisons between the MLADM and the classical fourth-order Runge–Kutta method (RK4) reveal that this modified method is more effective and convenient.

8. Gupta, V and Kumar, P (2012) In this paper, we present an algorithm of the Laplace homotopy analysis method (LHAM) to obtain the solutions for system of nonlinear fractional partial differential equations. The fractional derivatives are considered in Caputo sense. The proposed algorithm gives a procedure for constructing the set of base functions and gives the high order deformation equations in simple form. This method is applied to solve four systems of nonlinear fractional partial differential equations. Numerical results shows that lham is easy to implement and accurate when applied to solve system of equations.

9. Ansari, A (2012) In this article, we introduce a new generalized Laplace transform and derive the complex inversion formula, convolution theorem and generalized product theorem for the transform. Furthermore, the fundamental solutions of two Cauchy type fractional diffusion equation of single and distributed order are given by means of new transform in terms of the Wright functions. Also, applicability of this transform in evaluation of improper integrals of special functions is stated.

10. Nikolova, Y (2012) In this paper we propose some methods for solving fractional order differential equations with variable coefficients. To this aim, we consider suitable generalizations of the classical integral transforms of Fourier, Mellin and Laplace, and study their basic properties. First we consider some ordinary differential equations of fractional order with variable coefficients. The solutions obtained by means of integral transforms are expressed in terms of special functions, as the
Wright function and 1- and 2-parametric Mittag-Leer functions. The method of integral transforms is used also to solve partial differential equations of the same kind. Namely, a generalized Laplace transform is applied to solve the so-called Giona equation and the fractional wave equation. Special attention is paid also to the generalized fractional heat equation involving a generalization of the Riemann-Liouville fractional derivative. A combined application of the Laplace transform and of the generalized Fourier transform leads to a solution of Cauchy problem for this equation in explicit integral form, where the kernel is represented by the 1-parametric Mittag-Leer function.

11. **Kumar, S.E (2012)** In this paper, Laplace homotopy perturbation method, which is combined form of the Laplace transform and the homotopy perturbation method, is employed to obtain a quick and accurate solution to the fractional Black Scholes equation with boundary condition for a European option pricing problem. The Black-Scholes formula is used as a model for valuing European or American call and put options on a non-dividend paying stock. The proposed scheme finds the solutions without any discretization or restrictive assumptions and is free from round-off errors and therefore, reduces the numerical computations to a great extent. The analytical solution of the fractional Black Scholes equation is calculated in the form of a convergent power series with easily computable components. Two examples are presented.

12. **Rubanra, S And Sangeetha, J (2013)** This paper deals with fuzzy Laplace transform to obtain the solution of fuzzy fractional differential equation (FFDEs) under Riemann Liouville H-differentiability. This is in contrast to conventional solution that either require a quantity of fractional derivative of unknown solution at the initial point (Riemann Liouville) or a solution with increasing length of their support (Hukuhara), using the fuzzy Laplace transform to solve differential equation with fractional order (0 << 1). The best of our knowledge, there is limited research devoted to the analytical method to solve the FFDEs under Riemann Liouville H-differentiability. An analytical solution is presented to confirm the capability of proposed method.

13. **Aghili, A And Zeinali, H (2013)** In this work, the authors implemented Laplace transform method for solving certain partial fractional differential equations and Volterra singular integral equations. Constructive examples are also provided to
illustrate the ideas. The result reveals that the transform method is very convenient and effective

14. **Loonker,D AndBanerji,P (2013)** The fractional calculus for the Natural transform is introduced and some non homogeneous fractional ordinary differential equations are solved using Natural transform.

15. **Gorial,I (2013)** In this paper, we use the analytical solution the fractional dispersion equation in two dimensions by using modified decomposition method. The fractional derivative is described in Caputo's sense. Comparing the numerical results of method with result of the exact solution we observed that the results correlate well. Keywords: Modified decomposition method, Fractional derivative, Fractional dispersion equation.

16. **Al-Azawi,S.N (2014)** We consider the fractional differential equations with constant coefficients, using Osler definition In this paper we have proven that the uniqueness of solution of fractional differential equation, and solve this equation by using the Laplace transform technique.

17. **Karbaalaie,A.E (2014)** In this study, we propose a new algorithm to find exact solution of nonlinear time-fractional partial differential equations. The new algorithm basically illustrates how two powerful algorithms, the homotopy perturbation method and the Sumudu transform method can be combined and used to get exact solutions of fractional partial differential equations. We also present four different examples to illustrate the preciseness and effectiveness of this algorithm.

18. **Morita,T (2014)** In a preceding report, a method was presented to give the solution for the initial-value problem of a fractional differential equation when the initial values were the values of the function and its integer-order derivatives. It is now shown that the solution can be obtained in a less restricted condition. The discussions here are restricted to linear equations with constant coefficients, which can be solved with the aid of the Laplace transform. The main discussions are given when we adopt the Riemann-Liouville fractional derivative, and some comments are added when we use the Caputo derivative or its modification.

19. **Aghili,A AndMasom,M.R (2014)** In the present paper, time fractional partial differential equation is considered, where the fractional derivative is defined in the Caputo sense. Laplace transform method has been applied to obtain an exact solution. The authors solved certain homogeneous and nonhomogeneous time fractional heat
equations using integral transform. Transform method is a powerful tool for solving fractional singular Integro-differential equations and PDEs. The result reveals that the transform method is very convenient and effective.

20. **Sharma, S.C And Bairwa, R.K (2014)** In the present paper, generalized time-fractional biological population model is solved by the use of iterative Laplace transform method (ILTM). The fractional derivatives are described in the Caputo sense and the solutions obtained in closed form, in terms of Mittag-Leffler functions. An illustrative numerical case study is presented for the proposed method to show the preciseness and effectiveness of the method.

21. **Biala, T.A (2014)** This paper is concerned with obtaining the exact solutions of linear and nonlinear delay differential equations (DDEs) via a combination of the Laplace transform and variational iteration method. In this approach, a correction functional is constructed by a general Lagrange multiplier, which is determined by using the Laplace transform with the variational theory. Numerical examples are given to elucidate the solution process, the simplicity, efficiency and reliability of the new approach.

22. **Takaci, D (2014)** In this paper the exact and the approximate solutions of fuzzy fractional differential equation, in the sense of Caputo Hukuhara differentiability, with a fuzzy condition are constructed by using the fuzzy Laplace transform. The obtained solutions are expressed in the form of the fuzzy Mittag-Leffler function. The presented procedure is visualized and the graphs of the obtained approximate solutions are drawn by using the GeoGebra package.

23. **Chad Pal, S.E (2014)** Fractional Homotopy Analysis Transform Method (FHATM) is a new analytical technique for solving non homogeneous and homogeneous fin equation. The FHATM is an innovative adjustment in Laplace Transform Algorithm (LTA) and makes the calculation much easier. The non linear problem is solve by proposed technique without using adomian polynomials and He’s polynomial which can be consider as a clear advantage of this new algorithm over decomposition and homotopy perturbation transform method. In this paper it can be seen that the auxiliary parameter h which controls the convergence of the HATM approximate series solution and it also can be used in the predicting and calculating multiple solution. This is a basic technique which gives more qualitative difference in analysis between FHATM and other method. This indicate that the solution obtained by
proposed method is easy to implement and computationally very attractive. This proposed method is illustrated by solving a fin with temperature dependent internal heat generation and constant thermal conductivity.

24. **Sontakke, B.R And Shaikh, A.S (2015)** The purpose of this paper is to demonstrate the power of two mostly used definitions for fractional differentiation, namely, the Riemann-Liouville and Caputo fractional operator to solve some linear fractional-order differential equations. The emphasis is given to the most popular Caputo fractional operator which is more suitable for the study of differential equations of fractional order. Illustrative examples are included to demonstrate the procedure of solution of couple of fractional differential equations having Caputo operator using Laplace transformation. It shows that the Laplace transforms is a powerful and efficient technique for obtaining analytic solution of linear fractional differential equations.

25. **Choudhary, S (2015)** Presently, many researchers have demonstrated the utility of fractional calculus in the derivation of particular solutions of a considerably huge number of linear ordinary and partial differential equations of the second and higher orders. Laplace decomposition technique is applied to achieve series solutions of nonlinear fractional differential equation. The method is based mainly upon some general theorems on (explicit) particular solutions of some families of fractional differential equations with the Laplace transform and the expansion coefficients of binomial series. A major advantage of fractional calculus is that it can be considered as a super set of integer-order calculus. Thus, fractional calculus has the potential to achieve what integer-order calculus cannot. It has been suppose that many of the enormous future developments will come from the applications of fractional calculus to different fields. Laplace transform is a very influential mathematical tool applied in various areas of engineering and science. With the increasing complexity of engineering problems, Laplace transforms help in solving complex problems with a very straightforward approach just like the applications of transfer functions to solve ordinary differential equations. It will allow us to transform fractional differential equations into algebraic equations and then by solving these algebraic equations. The unknown function by using the Inverse Laplace Transform can be obtained.

26. **Mahgob, M.M And Elzaki, T.M (2015)** The aim of this paper, is to study the integro-differential equations with a bulge function, to find the exact solution we use Elzaki transform, inverse Elzaki transform and the convolution theorem. This method is
more efficient and easy to handle such partial differential equations and integro-differential equations with a bulge function in comparison to other methods. The result showed the efficiency, accuracy and validation of Elzaki transform method.

27. Sontakke, B.R And Shaikh, A.S (2015) The purpose of this paper is to demonstrate the power of two mostly used definitions for fractional differentiation, namely, the Riemann-Liouville and Caputo fractional operator to solve some linear fractional-order differential equations. The emphasis is given to the most popular Caputo fractional operator which is more suitable for the study of differential equations of fractional order. Illustrative examples are included to demonstrate the procedure of solution of couple of fractional differential equations having Caputo operator using Laplace transformation. It shows that the Laplace transforms is a powerful and efficient technique for obtaining analytic solution of linear fractional differential equations.

28. Sharma, V.D And Khapre, S.A (2015) In the literature there are numerous integral transform and widely used in physics astronomy as well as in engineering. In order to solve differential equation, the integral transform were extensively used and thus there are several works on the theory and application of the integral transform such as Laplace, Fourier-Mellin & Hankel, Cosine and Sine transform to name but a few. In the sequence of these transform, PeiSoo-Chang redefined the fractional Sine and fractional Cosine transform based on fractional Fourier transform in 2001. An integral transform is useful if it allows one to turn a complicated problem into a simpler one. In this paper, an application of fractional sine transform to differential equation is presented.

29. Tie, L (2015) Fractional order has the characteristics of memory and non-locality and it is different with integer order. Therefore, fractional differential equations can be used to describe some abnormal natural phenomena. At the same time, how to solve the fractional order partial differential equation and differential equations with fractional order has become a very important research field. Besides analytic solution, it is also important to investigate the numerical methods for fractional differential equations. In the paper, fundamental solution of the time fractional partial differential equation has been deduced, which is derived by Furrier transform and Laplace transform. According to the simulation, there is little difference between numerical solution and the exact solution when the solution is the time variable function. The results show the validity of the method.
30. **Makwana, V (2015)** Laplace transform is a very powerful mathematical tool applied in various areas of engineering and science. This paper presents an overview of the Laplace transform along with its application to several well-known in RLC electrical circuits. We obtain the solution of a fractional differential equation associated with a RLC electrical circuit.

31. **Ali, M, F (2015)** In this paper, an attempt as an application, we obtain the solution of fractional differential equation associated with a electrical circuit, using Heaviside function in a closed form in terms of the Mittag-Leffler function. Mathematics Subject Classification: 26A33, 33E12 Keywords: RLC Electrical circuit, Mittag-Leffler function and its extensions, Fractional derivatives.

32. **Mistry, L. E (2016)** With the research done in past three decades, the subject of fractional calculus has gained much importance due to the application in diverse field in science and engineering. The fractional derivatives and integrals enable the description of the memory and hereditary properties. Hence there is growing need to find the solutions behaviour of these fractional differential equations. In this paper we reviewed the literature about the basics, standard approaches, analytical and approximate methods to the problem of fractional differential equations, while discussing about the basic properties including the rules for their compositions and the conditions for the equivalence of various definitions.