Chapter 6

Overall Conclusion and Future Scope

The diffusion of solutes in presence of advection and reaction phenomena has been discussed and analyzed using Cahn-Hilliard equation in chapter 2 under given initial and boundary constraints. The Laguerre polynomial is used with the spectral technique to analyze solute behavior. This numerical technique has also been used to analyze solute diffusion in porous medium for two dimensional case given in chapter 3 in the presence of source term and sink term with the help of a two-dimensional diffusion model. In chapter 4, it is extended to deal a mathematical model containing two solute variables. The author is optimist that the numerical solution by the proposed algorithm can be extended to a wide range i.e., for solving 3D non-linear time-space fractional order diffusion equations which will be the topic of my future research.

An iterative scheme for the numerical solution of the space-time fractional order two-dimensional reaction-advection-diffusion equation applying homotopy perturbation with Laplace transform arising in porous media is discussed in chapter 5. The characteristic of solute variables have been discussed using Caputo fractional-order derivatives. The future work will be focused on finding the solutions of the proposed mathematical model
(i) for the case of the system of PDEs,
(ii) with non-linearity in dispersion terms,
(iii) the multi dimensional variable fractional order reaction-advection-diffusion equations. The proposed method can be utilized to investigate the behavior of more typical and highly non-linear system of PDEs. It is observed that this numerical scheme is an efficient and accurate numerical tool to deal the complex type nonlinear fractional order systems and

therefore it can be used to deal with nonlinear dynamical complex systems arising in various branches of applied science.

As the physical importance and applications of fractional order non-linear RADEs are found in solute transport through porous media therefore there are many future scopes of these equations with various initial and boundary conditions like Neumann boundary conditions, Dirichlet boundary conditions and Robin-type boundary conditions for coupled RADE in the two dimensional cases. These things motivated me to propose and analyze a number of mathematical models describing many physical processes in solute transport. These numerical techniques can be extended to analyze the behavior of multi-dimensional space-time fractional aerosol transport problems.