Time domain analytical methods for multi-state problems in quantum & statistical physics

The multistate models appear in many areas related to science that explains the physics of many complex systems. The theory of such systems is often explained by statistical physics or quantum physics. Multistate models belong to the fundamental analysis of processes of many kinds, few are the collision and spectroscopic processes. So far, the multistate models often explained by Smoluchowski/Schrodinger equation has few analytically solvable models where the available solutions recede long back from the realistic scenario. The solutions available in the literature are in Laplace domain. Unfortunately, Inverse Laplace transform is not available even for many simpler cases. Moreover, Laplace domain solutions are understood by defining a new entity called rate constant that gives the kinetic picture of the reaction. But the exact dynamics of the reaction/reactant species is known by analysing the models in the time domain. In this thesis, We develop mathematical methods to solve the multistate problems in the time domain that can have applications in understanding variety of such dynamical processes.

Thesis chapters:

1. Introduction.
2. Time domain methods in statistical mechanics and quantum mechanics.
3. Time domain method to solve the multistate problems in statistical mechanics.
4. Time domain method to solve the multistate models of quantum mechanics.
5. Numerical approach to solve the problems of quantum and statistical physics.
6. Summary & Conclusion.