

# Abstract

In earlier investigations the Riemann-Liouville or Caputo fractional order derivatives were used on fractional order systems but these techniques have some flaws which cannot be ignored as recent studies have shown. Therefore, new definitions, such as Caputo-Fabrizio fractional order (CFFO), have been established to overcome these flaws. In this research our main goal is to understand the dynamics and transmission of HIV/AIDS into various classes. To that purpose, we include exposed, post-exposure prophylaxis (PEP) treatment, AIDS, and treated classes in a SIR model. To understand the dynamics of disease, local and global stabilities, DFE and EE points are computed. Similarly, implementing the next-generation matrix procedure, calculation is done for the reproduction number  $R_0$  at disease-free equilibrium point for the model in consideration. Using the sensitivity analysis technique it was determined which parameters greatly impact the reproduction number  $R_0$  and which compartment's population can be controlled. Through this, we propose an improved version of CFFO for the HIV and AIDS epidemic. Optimizing control was designed by controlling the transmission rate of susceptible and infectious people and by changing the sexual practices of susceptible people. Lastly numerical simulations are provided along with a graphical representation of the results.