

Abstract

In this dissertation, we are going to explore the fractional differential equations related to various vibration phenomena. We shall cover the Bagley-Torvik equation, the composite fractional relaxation differential equation and the motion of a linear oscillator employing the fractional derivative operator in the sense of Atangana-Baleanu in further detail. The fractional parameter's value, that indicates the presence of fractional structures in the system and is consistent with physical systems, must fall within a unit interval. The fractional parameter determines how the non-integer order differential equation's solutions are derived and stated in terms of generalized functions. By approaching unity with the limit of the fractional parameter, the classical examples can be reconstructed. Additionally, we will compare and analyze how the fractional order parameter affects the dynamics of the models and draw applicable conclusions.