Developing Mathematical Structures for Integrals to Enhance the Applicability of Integral Equations and Integro-differential Equations

N.C. Ganegoda
University of Sri Jayewardenepura, Sri Lanka

Abstract

Integral equation is an equation in which the unknown function appears inside a definite integral. One of the simplest type can be given as $y(t) = \int_0^t f(s, y(s))ds$ where the solution is expected for $y(t)$. Once we have at least one variable limit in the integral, then the integral equation is called Volterra integral equation. Further, such equation is called as of second kind once the unknown function appears both inside and outside the integral. There is another type called Fredholm integral equations in which the limits of integration are fixed. In integro-differential equations, unknown function in the equation is involved in a derivative as well as an integral.

Involvement of an integral allows to model many real world phenomena via those equations. It ranges from applications in physics to biology. Thus, developing mathematical structures to enhance the applicability of integrals in those equations has gained a good research potential. Here, by mathematical structures we mean a collection of objects such as functions, numbers which are arranged with certain operations such as addition, multiplication etc. other than to the operation integration. Our main focus is to investigate the options which are not common in modeling processes. For an instance, we may replace Riemann integration by Lebesgue integration and see the opportunity of handling it in applications as well as in solving methods.

Keywords: Integral equations, integro-differential equations, mathematical structures