ME Seminar

Fractional Derivatives and Their Applications

Om P. Agrawal, Professor Emeritus, Southern Illinois University

ABSTRACT

Considerable progress has been made in the area of Fractional Derivatives and Their Applications in the past two decades. Fractional Calculus has now been used in almost every field of science, engineering, economics, and applied mathematics. However, many researchers still remain unaware of this field, and very few universities offer courses in this area at the graduate level and almost none at the undergraduate level.

In this talk, I will first introduce some of the concepts of fractional derivatives. Then, I will apply these concepts to formulate three examples, namely, a Tautochrone problem, a thermal modeling of aircraft disk brakes, and a modeling of an elastic bar on a viscus surface. For the disk-brake example, some analytical results will be presented, and they will be validated experimentally. Some other engineering problems, where Fractional Calculus has been applied, will be stated. If time permits, a Simulink block for 1/2 order integrator will be developed, and it will be shown how it can be used to solve a fractional differential equation.

ABOUT THE SPEAKER

Professor Om Prakash Agrawal received his Ph.D. from the University of Illinois at Chicago. Initially, he worked in the areas of Dynamic Analysis and Control of Flexible Multibody Dynamics, Finite Element Modeling and Analysis, and Optimal Control. For the past 20 years, he has been actively involved in research in the area of Fractional Derivatives and Their Applications. Some of his work in this area include Fractional Variational Calculus, Fractional Euler-Lagrange Equations, Deterministic and Stochastic Analysis and Control of Fractional Dynamic Systems, Analytical and Numerical Solution of Fractional Diffusion and Wave Equations, and Numerical Schemes for Fractional Differential Equations. His work on Fractional Euler-Lagrange Equations has been called Agrawal's Principle by some experts in the field. His work has been the starting point of several research in the area of Fractional Calculus. In 2003, he organized the first symposium on Fractional Derivatives and Their Applications. Since then, he has organised several symposiums in the field. His work has been cited in more than 90these books discuss his work extensively. Professor Agrawal has also been a guest/invited/keynote speaker at several symposiums/workshops and conferences and universities. He has been an associate editor of several journals, and a guest editor of some special issues on Fractional Calculus.

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