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Electromagnetic waves described by a fractional derivative of variable and constant order with non singular kernel. (English) Zbl 1475.34005

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Summary: The concept of differential operator with variable order has attracted attention of many scholars due to their abilities to capture more complexities like anomalous diffusion. While these differential operators are useful in real life, they can only be handled numerically. In this work, we used a newly introduced variable order differential operators that can be used analytically and numerically, has connection with all integral transform to model some interesting mathematical models arising in electromagnetic wave in plasma and dielectric. The differential operators used are non-singular and have the crossover properties therefore the models studied can explain the propagation of the wave in two different layers which cannot be achieved with those differential variable order operators with singular kernels. Using the Laplace transform and its connection with the new differential operator, we derive the exact solution of the models under investigation.

MSC:

34A08 Fractional ordinary differential equations
97M10 Modeling and interdisciplinarity (aspects of mathematics education)
26A33 Fractional derivatives and integrals
78A25 Electromagnetic theory (general)

Keywords:

Atangana-Koca fractional derivative; fractional operators; dielectric media; Laplace transform; Mittag-Leffler function; wave propagation

Full Text: DOI

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