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Electromagnetic field computation at fractal dimensions[1] M ZUBAIR, Y.S. ANG, L.K. ANG, Singapore University of Technology and Design — According to Mandelbrots work on fractals, many objects are in fractional dimensions that the traditional calculus or differential equations are not sufficient. Thus fractional models solving the relevant differential equations are critical to understand the physical dynamics of such objects. In this work, we develop computational electromagnetics or Maxwell equations in fractional dimensions. For a given degree of imperfection, impurity, roughness, anisotropy or inhomogeneity, we consider the complicated object can be formulated into a fractional dimensional continuous object characterized by an effective fractional dimension D, which can be calculated from a self-developed algorithm. With this non-integer value of D, we develop the computational methods to design and analyze the EM scattering problems involving rough surfaces or irregularities in an efficient framework. The fractional electromagnetic based model can be extended to other key differential equations such as Schrodinger or Dirac equations, which will be useful for design of novel 2D materials stacked up in complicated device configuration for applications in electronics and photonics.

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