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A design-oriented analytical approach to simplify the computational aspects of low pass planar multi EMI filters

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2016
http://hdl.handle.net/10539/20046

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Abstract

Industry pressures of fabricating smaller components coupled with Electromagnetic Compliance (EMC) regulations are driving the development of alternative solutions in the EMI space. A possible solution to EMC lies in distributed frequency-selective filters, such as multipath conductors. The involved complexity in the field, however, hinders interest and capabilities for potential researchers and engineers working in this domain. The ability to design multipath conductors is identified as a restrictive aspect to advancing in the field of low pass filter design using these conductors. This work aims to develop a design-oriented analytical approximation approach, using established methods, for a given desired resistance-frequency plot. The method aims to provide designers with an initial design that can be refined subsequently using more involved techniques. This stands to broaden the scope of this field from experts to non-experts by allowing easier analysis and design processes. The approach develops from a low frequency method of modelling multipath conductors as separate structures that are valid over different frequency bands. A method is developed to model multipath structures as theoretical single layer conductors composed of effective material property values. This approach forms the basis on which the design-oriented equations are developed solving for the material properties of the required structure. The approaches developed are against the exact full frequency analytical equations. Practical aspects to the design of multipath conductors in this manner are discussed with main goal of feasible, stable design.