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Absorption beyond Rozanov bound by LTI surfaces

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Dallenbach layer is composed of an absorbing magnetic-dielectric layer attached to a perfect electric conductor (PEC) sheet. Under linearity and time invariance (LTI) assumptions Rozanov has established analytically a sum-rule trade-off between the absorption efficiency over a predefined bandwidth and the thickness of the layer, that is the so called Rozanov bound. In recent years several proposals have been introduced to bypass this bound by using non-LTI absorbers [1-2]. However, in practice, their implementation may be challenging due to the need to encapsulate together the wave system and the modulation network. Therefore, passive, and stationary, methodologies for wave absorption beyond the bound are desired. Here, we introduce several new sum rules for LTI layer absorbers that are not covered by the original Rozanov's criterion, and give rise to more relaxed constraints on the absorption limit. We then, demonstrate practical LTI designs of absorbing thin layers that provide absorption beyond the Rozanov's bound. These designs are based on the introduction of a hypothetical effective magnetic conductivity in the Dallenbach layer, or by replacing the original PEC boundary by a penetrable impedance sheet [3]. In addition, we explore the problem of wave absorption for wide angle wide band applications, and discuss several interesting designs for this problem as well.

References

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