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Deriving the microstructural parameters of sea foam from experimental measurements WAI SOEN CHAN, HON PING LEE, KIN WAH YU, Department of Physics, The Chinese University of Hong Kong — We have studied the effective dielectric constant of sea foam by exploiting its spectral structure. We have considered sea foam as a two-phase composite containing air and sea water, at scale where the quasi-static limit is valid. McPhedran and co-workers derived tight bounds of the structural parameters of such composite when a set of measured data is given. However, determining the exact structural parameters have not been successful. We have performed an inverse algorithm, attempted to determine the structure of the foam given measured data of dielectric constant. We model the sea foam by a multilayered Hashin-Shtrikman structure consisting of air embedded in sea water with decreasing air volume fraction from the top to bottom. We first express the effective permittivity of the foam using spectral representation as proposed by Bergman and Milton. Then, by an optimization approach, we determine the spectral parameters, namely the zeros and poles. Next, we convert these spectral parameters into structural parameters by an algorithm proposed by Sun and Yu. Hence the structure of foam could be determined. The inverse problem of determining the sea foam structure is important in marine science. Sea surface wind speed and salinity could be determined from properties of sea foam.

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