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# Numerical design of Alberich anechoic coatings with superellipsoidal cavities of mixed sizes

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Thin rubber coatings with cavities in a doubly periodic lattice are able to reduce reflections of underwater sound by redistributing normally incident energy such that absorption in the surrounding rubber is enhanced. For spherical scatterers, the anechoic effect can be studied numerically by the layer multiple-scattering method. In comparison to more flexible but also more computer intensive methods, such as FEM modeling, there are two important advantages. An improved physical understanding of the anechoic effect can be achieved by simplified semianalytical analysis, and the high computational speed allows modern global optimization techniques to be applied for coating design. In this paper, the flexibility of the layer multi-scattering method is improved by combination with an efficient algorithm for numerical computation of transition matrices for superellipsoidal scatterers. Extensions to mixtures of nonspherical scatterers of different types are also considered, in order to enhance the broad-band performance. Symmetry properties are used to reduce the size of the pertinent equation systems. Examples of numerical coating design for underwater acoustic applications are presented, using differential evolution algorithms for the optimization.