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Optimal Three-Material Wheel Assemblage of Conducting and Elastic Composites.

We describe a new type of three material microstructures which we call *wheel assemblage*, that correspond to extremal conductivity and extremal bulk modulus for a composite made of two materials and an ideal material. The exact lower bound for effective conductivity and matching laminates were found in (Cherkaev, 2009) and for anisotropic composites, in (Cherkaev, Zhang, 2011). Here, we show different optimal structures that generalize of the classical Hashin-Shtrikman coated spheres (circles). They consists of circular inclusions which contain a solid central circle (hub) and radial spikes in a surrounding annulus, and (for larger volume fractions of the best material) an annulus filled with it. The same wheel assemblages are optimal for the couple of dual problems of minimal conductivity (resistivity) of a composite made from two materials and an ideal conductor (insulator), in the problem of maximal effective bulk modulus of elastic composites made from two linearly elastic material and void, and the dual one. (Received August 30, 2011)