

Advanced homogenization approach for a plasma dielectric mixture: Case of a turbulent tokamak

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Homogenization methods for dielectric mixtures have been used extensively in the past for a wide range of complex media. In this study the case of interest is a magnetized plasma medium, which by default is a subcategory of gyrotropic media. Embedded in an ambient plasma of a given density profile are turbulent structures at a different density (blobs) of various shapes from long filamentary structures to ellipsoids aligned to the local magnetic field lines. The classical homogenization approach is very limited in our case, strongly depended on low volume fractions for the blobs and wavelengths of the incident radio frequency waves. In our study we use Fourier space components for the electric and magnetic fields (scattered and excited within the blobs) that, in turn, are seen as eigenvectors of the dispersion relation matrix. Using Green's function approach for the ambient plasma leads to an equation for the homogenized dielectric tensor. The parameters used are those implemented for a series of experiments performed on devices such as TORPEX and TCV.

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