MediaV Lecture I

Large Electric field enhancement in between two nearly touching conductors with extreme conductivities

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Two nearly touching inclusions with extreme conductivities can cause the enhancement of the electric field. In an external electric field of long wavelength compared to the size of conductors, the presence of nearly touching conductors induces a very large electric field confined in the narrow gap region between the conductors. In this talk, we analyze this field enhancement based on the quasi-static approximation and the related conductivity equation for the electric scalar potential. The generic blow-up rate of the gradient of the solution to the conductivity problem in presence of two perfect conductors is $|\epsilon \ln \epsilon|^{-1}$ in three dimensions and $\epsilon^{-1/2}$ in two dimensions, where ϵ is the distance between the two conductors. I present asymptotic formulas for the solution to the conductivity problem, which characterize the gradient blow-up of the solution. The analysis is based on the bipolar coordinates and the bispherical coordinates in two dimensions and three dimensions, respectively.

MediaV Lecture II

Inverse Problems in Fluorescence Photoacoustic Tomography

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Quantitative fluorescence photoacoustic tomography (QfPAT) aims at reconstructing fluorescence distributions inside a medium from photoacoustic measurements. We present in this talk some recent theoretical results on QfPAT in diffusive regime and some computational results in the transport regime, assuming the availability of multiple internal data sets from ultrasound inversion.