

Mathematics Graduate Seminar

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Thursday, November 17, 2016
1:00p.m., HH-3017

Asymptotic Analysis of the Perturbed Poisson Boltzmann Equation on Unbounded Domains

Abstract:

We study the existence, uniqueness and asymptotic expansions to perturbed Poisson Boltzmann equations on an unbounded domain. A shooting method is applied to prove the existence and uniqueness of the exact solution. As to the approximation to the regularly perturbed Poisson Boltzmann equation, we convert it into an integral equation and a uniformly convergent asymptotic expansion based on the iteration of successive approximations is provided with a rigorous proof. For the singularly perturbed problem, since the typical Poincaré-type outer solution is the constant zero, we then use the inner-layer asymptotic formula to approximate the true solution in the whole domain. Our proof verifies that these expansions do give a valid approximation globally. A further discussion on the exponentially-matched asymptotic expansions is also presented.