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# Kinetic Lecture Series

## Asymptotic Problems for Kinetic Equations in Bounded Domains

by

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*Lehigh University*

**Abstract:** In these lectures, I will discuss the hydrodynamic limits of kinetic equations in bounded domains. In particular, I will focus on the diffusive limit of the neutron transport equation with boundary layer effect. We will start from the basic knowledge about asymptotic analysis and perturbation theory (including regular perturbation and singular perturbation). Then we will utilize the Hilbert expansion to treat the 1D case and briefly discuss the Milne problem. Finally, we will study the 2D/3D case with smooth convex domains and highlight the geometric effects of the domains on the boundary layer. We will analyze the difficulty of the classical theory and provide a fresh construction of the kinetic boundary layer.

**References:**

- [1] Peter Miller. Applied asymptotic analysis. Graduate Studies in Math, 75. AMS, Providence, RI, 2006.
- [2] Alain Bensoussan, Jacques-L. Lions, and George C. Papanicolaou. Boundary layers and homogenization of transport processes. Publ. Res. Inst. Math. Sci., 15:53-157, 1979.
- [3] Yoshio Sone. Kinetic theory and fluid dynamics. Birkhauser Boston, Inc., Boston, MA, 2002.
- [4] Lei Wu. Asymptotic analysis of transport equation in bounded domains. arXiv:2002.02766.
- [5] Lei Wu and Zhimeng Ouyang. Asymptotic analysis of Boltzmann equation in bounded domains. arXiv:2008.10507.

### Lecture 1: Basic Perturbation Theory

Date & Time: November 27, 2020 (Friday); 10:00am - 11:30am (Hong Kong SAR)

Zoom link:

<https://cuhk.zoom.us/j/99003762184?pwd=VW1yOXI4Wi9JZFdERjZWeU12cEdKQT09>

Meeting ID: 990 0376 2184, Passcode: 776234

### Lecture 2: Diffusive Limit of Neutron Transport Equation

Date & Time: December 4, 2020 (Friday); 10:00am - 11:30am (Hong Kong SAR)

Zoom link:

<https://cuhk.zoom.us/j/94109496541?pwd=K2M2aINBQTJRVzYyV3RITFErcnYwZz09>

Meeting ID: 941 0949 6541, Passcode: 395824

### Lecture 3: Boundary Layer with Geometric Correction

Date & Time: December 11, 2020 (Friday); 10:00am - 11:30am (Hong Kong SAR)

Zoom link:

<https://cuhk.zoom.us/j/98907984074?pwd=VHRCbjNaZ1MrU09GZ2UvZ2hPYnRaUT09>

Meeting ID: 989 0798 4074, Passcode: 956938

*All are Welcome*