

**The Hong Kong Polytechnic University  
Department of Applied Mathematics**

**Colloquium**

**The Pseudo Two Dimensional Model for Lithium Ion Batteries:  
When is it Really Needed?**

**By**

**Prof. Brian Wetton  
The University of British Columbia**

**Abstract**

The pseudo two dimensional (P2D) model for Lithium ion battery electrodes was introduced by Doyle, Fuller and Newman in 1993 [J. Electrochem. Soc. 140, 1526-1533]. The model describes intra-particle diffusion of intercalated Lithium as well as transport of Lithium ions in the electrolyte across the width of the electrode. It is known that both these effects are needed to properly describe the operation of some batteries of this type in high current operation. However, it is also known that simplifications can be made to the electrochemical model and accurate results obtained in some situations, and in others even equivalent circuit models have sufficient accuracy. In this work, the authors give a quantitative picture (in terms of material parameters and operating current) of conditions where P2D models are needed for accurate simulation and where simpler models can be used without introducing significant errors. The results are obtained using a combination of scaling and asymptotic analysis together with quantitative criteria from well resolved computations. An introduction to Lithium ion battery operation suitable for a mathematical audience will be given. Time permitting, some recent results on a fast computational implementation of the P2D model will also be discussed.

**Date: 7 October 2021 (Thursday)**

**Time: 10:00-11:00 (Hong Kong Standard Time GMT +8)**

**Venue: Online Talk via Zoom (Meeting ID: 939 9619 1269)**

**Speaker: Prof. Brian Wetton, The University of British Columbia**

**Host: Prof. Zhonghua Qiao, The Hong Kong Polytechnic University**

**Click to join**

<https://polyu.zoom.us/j/93996191269?pwd=U2R2ZStsa29UcmZBVjUvMTIHXOHRLdz09>



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**\*\*\* ALL ARE WELCOME \*\*\***

For enrolment, please send your name and email to [wai-yan.moon@polyu.edu.hk](mailto:wai-yan.moon@polyu.edu.hk) on or before 6 October 2021