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Abstracts

Computation, Analysis and Applications of PDEs with Nonlocal and Singular Operators

Date of tutorial lectures:
4 February 2022

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[An invitation to nonlocal and fractional models, part one: nonlocal models](#)

Abstract

There has been a growing interest in the study of nonlocal models as more general and sometimes more realistic alternatives to the conventional PDE models. We will devote two tutorial talks on the introduction of nonlocal and fractional models. In this first talk, we will focus on the nonlocal models with a finite range of nonlocal interactions, which serve as bridges connecting the classical PDEs, nonlocal discrete models and the fractional differential equations (which will be introduced in the second talk). This talk will cover topics including nonlocal modeling, nonlocal calculus and numerical methods for the nonlocal models.

2 Zhi Zhou

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[An invitation to nonlocal and fractional models, part two: fractional models](#)

Abstract

Fractional differential equations, one important class of nonlocal models, have received much recent attention in physics, biology and mathematics, due

to their extraordinary modeling capability for describing certain anomalous transport phenomena observed in real world. However, the relevant mathematical theory of fractional models is still far from complete when compared with the more established integer-order counterparts. The fractional differential operators involved in those models may significantly change both diffusive dynamics and solution regularity. The aim of this tutorial is to give a flavor illustrating distinct influences of the nonlocality of fractional operators.

This tutorial mainly consists of three parts:

1. First, I will introduce some basic ideas of fractional calculus;
2. Next, I will introduce some popular fractional models and their motivating applications;
3. Finally, I will introduce some solution theories and popular numerical approximations.