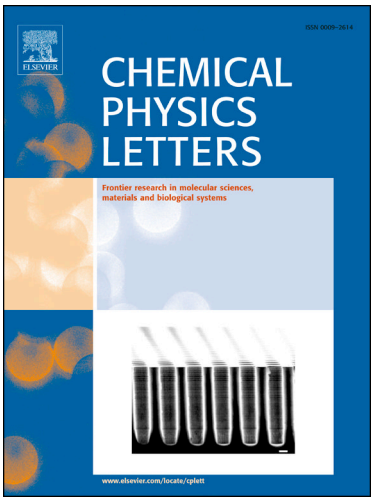

Research paper

An accurate computational method for the diffusion regime verification

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An accurate computational method for the diffusion regime verification

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Abstract. The diffusion regime (sub-diffusive, standard, or super-diffusive) is defined by the order of the derivative in the corresponding transport equation. We develop an accurate computational method for the direct estimation of the diffusion regime. The method is based on the derivative order estimation using the asymptotic analytic solutions of the diffusion equation with the integer order and the time-fractional derivatives. The robustness and the computational cheapness of the proposed method are verified using the experimental methane and methyl alcohol transport kinetics through the catalyst pellet.

Keywords: diffusion; anomalous diffusion; time-fractional diffusion; computational method; separation of variables

1 Introduction

In recent years, the fractional calculus tools were successfully applied to describing the transport phenomena in various contexts, especially concerning the anomalous diffusion. For the anomalous diffusion, various numerical schemes, as