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Analysis of reaction diffusion system via a new fractional derivative with non-singular kernel

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Abstract

In this paper, we obtain analytical solutions for the fractional cubic isothermal auto-catalytic chemical system with Caputo-Fabrizio and Atangana-Baleanu fractional time derivatives in Liouville-Caputo sense. We utilize the q-Homotopy analysis transform method to compute the approximate solutions. We find the optimal values of h so we assure the convergence of the approximate solutions. Finally, we compare our results numerically with the finite difference method and excellent agreement is found.

Keywords
Fractional isothermal auto-catalytic chemical systems, q-HATM, Caputo-Fabrizio, Atangana-Baleanu, h-curves.

1 Introduction

In this paper we consider the reaction-diffusion travelling waves that can be initiated in a coupled isothermal chemical system governed by cubic autocatalysis. We assumed that reactions took place along semipermeable membrane interfaces with the reaction on one interface (region I). The cubic isothermal, auto-catalytic reaction step in region (I) is given by

$$U + V \to 2V(rate\ r_1 uv^2), \tag{1}$$

with the step of the linear decay

$$V \to W(rate\ r_2 v), \tag{2}$$