Modeling the Dependence of Atmospheric Pressure with Altitude using Caputo and Caputo-Fabrizio Fractional Derivatives

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Abstract. This article is concerned with the model describes the relationship between the atmospheric pressure with altitude by converting the ordinary initial value problems (classical model) to fractional value problems involving Caputo and Caputo-Fabrizio fractional derivatives of real order. We investigate the existence and uniqueness of the proposed fractional model when Caputo-Fabrizio derivative is used. The aim is to show, based on experimental data from a real experiment and by using the root-mean-square deviation technique that the fractional approach may lead to a better estimation for the parameters than the ordinary one. A comparison between the error rates of the classical, Caputo, and Caputo-Fabrizio is also introduced.