A FRACTIONAL ORDER SEIR MODEL WITH DENSITY DEPENDENT DEATH RATE

Elif Demirci*†, Arzu Unal* and Nuri Özalp*

Abstract

In this paper, we introduce a fractional order SEIR epidemic model
with vertical transmission, where the death rate of the population is
density dependent, i.e., dependent on the population size. It is also
assumed that there exists an infection related death rate. We show the
existence of nonnegative solutions of the model, and also give a detailed
stability analysis of disease free and positive fixed points. A numerical
example is also presented.

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1. Introduction

Mathematical modeling in epidemiology provides new aspects in understanding the
spread of diseases, and it suggests control strategies [3]. One of the early models in
epidemiology was introduced in 1927 [9] to predict the spreading behaviour of a disease.
Since then, many epidemic models have been derived [8]. In [7] a detailed analysis for
integer order SEIR models with vertical transmission within a constant population can be
found. There are also several papers [12, 13] about epidemic models within a nonconstant
population, which is more realistic.

Although a large number of works has been done on modeling the dynamics of epidemi-
ological diseases, it has been restricted to integer order (delay) differential equations. In
recent years, it has turned out that many phenomena in different fields can be described
very successfully by the models using fractional order differential equations [1,2,4,6].

*Ankara University, Faculty of Sciences, Department of Mathematics, 06100 Be-
sevler, Ankara, Turkey. E-mail: (E. Demirci) `edemirci@science.ankara.edu.tr` (A. Unal)
`aogun@science.ankara.edu.tr` (N. Özalp) `nozalp@science.ankara.edu.tr`
†Corresponding Author.