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Application of Accretive Operators Theory to Linear SIR Model

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Abstract: In this paper, we discuss the existence and uniqueness results for a linear SIR (Susceptible-Infected-Recovered) model on L^p-spaces, for $1 \leq p < +\infty$. This work represents two extensions of the basic static linear model presented in [4]. Our analysis is fundamentally based on the accretive operators theory.

Keywords: *SIR; epidemic models; accretive operators; existence result; mild solution.*

Mathematics Subject Classification (2010): 92D30, 47H06, 35F10.

1 Introduction

In epidemiology, mathematical models have become important tools in analyzing the spread and control of infectious diseases caused by bacteria, viruses and fungi through a direct transmission from individual-to-individual: through a sneeze, cough, skin-skin contact and exchange of body fluids. Some examples of the diseases are: Coronavirus desease (Covid-19), Acquired Immune Deficiency Syndrome (AIDS), Ebola, Dengue fever, etc. The first mathematician who proposed a mathematical model describing an infectious disease is Daniel Bernoulli. In 1760, he modelled the spread of smallpox [8]. In our case, we are interested in the SIR model which can model Coronavirus desease. This model was first used by Kermack and McKendrick in 1927, and has subsequently been applied to a variety of diseases [13]. They have considered a constant total population and assumed that the interaction between the groups was determined by the disease transmission and removal rates. They have classified the population into three groups: susceptible (S), infected (I) and recovered (R). There have been many variations such as

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