ABSTRAK

Nailan Ni'mah Nasution, NIM 4173230018 (2021). Kontrol Optimal Dinamika Penyakit Covid-19 dengan Model SEIR.

Covid-19 (*Coronavirus Disease*) merupakan penyakit yang menyerang sistem pernafasan akibat infeksi SARS-CoV-2 (*Severe Acute Respiratory Syndrome*). Covid-19 pertama kali ditemukan di Wuhan, provinsi Hubei, Cina pada Desember 2019 dan dinyatakan sebagai pandemi oleh WHO pada Maret 2020. Peneliti dari berbagai bidang berkontribusi untuk mengatasi pandemi Covid-19. Ilmuwan matematika mempelajari karakteristik epidemi wabah, memprediksi penyebaran virus serta menawarkan berbagai langkah intervensi melalui pengembangan model matematika sehingga dapat mengendalikan penyebaran penyakit. Penelitian ini bertujuan untuk menganalisis stabilitas dan kontrol optimal dari model SEIR penyebaran Covid-19 dengan menerapkan strategi kontrol berupa vaksinasi individu rentan dan pengobatan individu terinfeksi. Analisis kestabilan dilakukan dengan menggunakan Kriteria Routh-Hurwitz dan analisis kontrol optimal dilakukan dengan menggunakan Prinsip Maksimum Pontryagin. Simulasi numerik analisis kestabilan dan kontrol optimal dilakukan dengan metode Runge-Kutta Orde 4 dan bantuan software Matlab R2015a menggunakan data penyebaran Covid-19 di Indonesia pada Agustus 2020-Agustus 2021. Analisis kestabilan menunjukkan bahwa dinamika Covid-19 di Indonesia akan mencapai titik stabil setelah mencapai 400 bulan. Analisis kontrol optimal menunjukkan bahwa strategi kontrol yang diterapkan efektif untuk menurunkan jumlah individu yang terinfeksi Covid-19 hingga 99%. Namun, penerapan strategi kontrol tidak dapat mempertahankan jumlah populasi.

Kata kunci: Analisis kestabilan, kontrol optimal, model SEIR, Covid-19

ABSTRACT

Nailan Ni'mah Nasution, NIM 4173230018 (2021). Optimal Control for The SEIR Model of Covid-19 Dynamic.

Covid-19 (*Coronavirus Disease*) is an acute respiratory system disease caused by SARS-CoV-2 (*Severe Acute Respiratoryiscovered Syndrome* 2). Covid-19 was first discovered in Wuhan, Hubei province, China in December 2019 and was declared a pandemic by World Health Organizatio in March 2020. Research from various disciplines is carried out to overcome the Covid-19 pandemic. Mathematicians develop mathematical models to study the characteristics of epidemic, predict the spread of viruses and offer various intervention measures. This study aims to analyze the stability and optimal control of the SEIR model for the Covid-19 dynamic in Indonesia by implementing control strategies in the form of vaccination of susceptible individuals and treatment of infected individuals. Stability analysis was performed using the Routh-Hurwitz criteria and optimal control analysis was performed using the Pontryagin Maximum Principle. Numerical simulations for stability analysis and optimal control were carried out the spread of Covid-19 in Indonesia in August 2020-August 2021. Stability analysis shows that the dynamics of Covid-19 in Indonesia will stable to occur for a long term, after reaching 400 months. Optimal control analysis shows that the control strategy implemented was effective in reducing the number of infected individuals to around 99%. However, the application of the control strategy could not maintain the population size.

Keywords: Stability analysis, optimal control, SEIR model, Covid-19