

BACHELOR'S THESIS
COVID-19 PANDEMIC SIMULATION BASED ON THE SIR
MODEL



JEREMY PAMUNGKUR DULIMAR

BACHELOR OF PHYSICS PROGRAM
PHYSICS DEPARTMENT
FACULTY OF SCIENCE TECHNOLOGY
UNIVERSITAS AIRLANGGA
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LEMBAR PENGESAHAN NASKAH SKRIPSI

Judul : COVID-19 Pandemic Simulation Based on the SIR Model
Penyusun : Jeremy Pamungkur Dulimar
NIM : 081511333089
Nama Pembimbing I : HERRI TRILAKSANA S.Si., M.Si., Ph.D
Nama Pembimbing II : FEBDIAN RUSYDI S.T., M.Sc., Ph.D.
Tanggal Seminar : 23-05-2022 9:00 AM

Mengetahui,

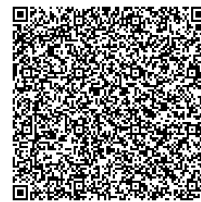
Pembimbing 1



HERRI TRILAKSANA S.Si., M.Si., Ph.D

NIP. 197712282003121003

Pembimbing 2



FEBDIAN RUSYDI S.T., M.Sc., Ph.D.

NIP. 197712282003121003

Mengetahui,
Ketua Departemen Fisika
Fakultas Sains dan Teknologi
Universitas Airlangga



HERRI TRILAKSANA S.Si., M.Si., Ph.D

NIP. 197712282003121003

This thesis is dedicated
to the author's beloved mother and father
Kuwu Senilawati and Aprianus Dulimar

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Author,



Jeremy Pamungkur Dulimar

NIM 081711333089

PREFACE

This research is a final project, one of the requirements to graduate from the Bachelor of Physics study program, Faculty of Science and Technology, Universitas Airlangga. This research studies the SIR model in its similarity to nuclear physics.

This research, was designed for a Bachelor student learning to design problem statement and research method. Chapter III contains the research flow method used in this research

The results of this research, and the discussion regarding the aforementioned results, are written in Chapter IV. *Mathematica* code input used for this research can be found in the Appendix.

Regards,

Jeremy Pamungkur Dulimar

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ABSTRAK

Riset ini mencoba membuat simulasi sebuah pandemi menggunakan Model SIR (*Susceptible - Infected - Removed*). Simulasi dilakukan menggunakan *Wolfram Mathematica*. Dalam riset ini, hasil simulasi pandemi dibandingkan dengan data COVID-19 dari Indonesia pada 18 bulan pertama, dan dengan data dari Jerman dan Tajikistan selama 24 bulan. Hasil riset menemukan bahwa SIR model dapat membuat simulasi gelombang pertama pandemi. Dari hasil simulasi, β dan α Indonesia selama 18 bulan pertama adalah $\beta = 2.12 \times 10^6$ dan $\alpha = 557.3$ untuk gelombang pertama pandemi. Simulasi untuk kasus varian Omicron di Jerman menghasilkan $\beta = 2.12 \times 10^7$, $\alpha = 5.41$. Dan, simulasi untuk gelombang pertama pandemi di Tajikistan menghasilkan $\beta = 0.0002$, $\alpha = 1869.5$.

Kata kunci: COVID-19, Nuclear Physics, Wolfram Mathematica.

ABSTRACT

This research tries to simulate a pandemic using the SIR (Susceptible - Infected - Removed) model. The simulation was done using *Wolfram Mathematica*. In this research, the SIR model simulation was compared to the COVID-19 data of Indonesia in the first 18 months, and to Germany and Tajikistan for 24 months. This research found that the SIR model able to simulate a single wave of a pandemic. From the simulation, the β and α for Indonesia for the first 18 months is $\beta = 2.12 \times 10^6$, and $\alpha = 557.3$ for the first wave of the Pandemic. The simulation for the Omicron outbreak in Germany results in $\beta = 2.12 \times 10^7$, $\alpha = 5.41$. And, the simulation for the main wave of pandemic in Tajikistan results in $\beta = 0.0002$, $\alpha = 1869.5$.

Keywords: COVID-19, Nuclear Physics, Wolfram Mathematica.

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