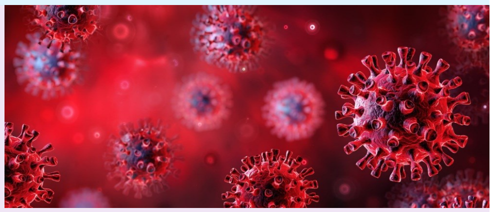
FAYETTEVILLE STATE UNIVERSITY™

The Henry Eldridge Department of Mathematics and Computer Science

Mathematical Modeling, Analyses, and Computer Simulation of SARS-CoV-2 Induced COVID-19 Disease



Abstract:

The goal of this research is to construct an epidemiologically efficacious mathematical model of the propagation of the SARS-CoV-2 induced COVID-19 disease in a non-isolated community, county, state, or country. The model variables consist of persons who are susceptible to SARS-CoV-2 virus; persons infected with the SARS-CoV-2 virus and who exhibit COVID-19 disease; persons who are asymptomatic or do not have a positive SARS-CoV-2 test after exposure to the virus; persons who are hospitalized with COVID-19 disease; persons who are recovering or in quarantine from less severe COVID-19 disease; and persons who die from complications due to COVID-19 disease. The model rate constants, parameters, and stoichiometric constants, transmission rate constraints are epidemiologically quantifiable and measurable.

Dynamical Systems Theory, Principles of Non-Linear Analysis and investigative computer simulations are used in analyzing the non-linear, coupled, and deterministic mathematical model. Mathematical expressions for the basic reproductive number R_0 have been derived using the Next Generation Matrix (NGM) method of Diekmann, Heesterbeek, and Metz. Robust epidemiologic criteria are derived depicting the persistence, annihilation, and recurrence of the SARS-CoV-2 induced COVID-19.

Investigative computer simulations are implemented to elucidate the various dynamical scenarios associated with the SARS-CoV-2 induced COVID-19 pandemic, including the attainment of the disease-free configuration. The model facilitates the real-time assessment of COVID-19 intervention protocols to evaluate the efficacy of intervention measures and determine whether herd immunity is attained. The simulations help to predict whether the SARS-CoV-2 virus is persistent in the community or is being annihilated.

Seminar Series Fall 2021

DATE

October 29, 2021

TIME

2:00—3:00 pm

Zoom Meeting: **Click to Join**

Meeting ID: **963 7030 0446**

Passcode: **980007**

PRESENTERS:

Dr. Frank Nani, Dr. Mingxian Jin, and Dr. Albert Chan

Professors at the Department of Mathematics and Computer Science

FSU

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