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Editorial: Modeling and numerical simulations with differential equations in mathematical biology, medicine, and the environment

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Editorial on the Research Topic

Modeling and numerical simulations with differential equations in mathematical biology, medicine, and the environment

The main objective of this Research Topic has been to bring academics, engineers, researchers and scientists to share recent ideas, methods, trends, problems and solutions in mathematical biology, medicine and the environment. There were four topic editors and the issue was open from August 2021 to May 2022 with a further extension of 6 months until November 2022 to submit papers. Fifteen papers were submitted, out of which ten were accepted and published. A total of 22 authors contributed papers in that Research Topic.

Manuscripts in this Research Topic were requested through a general call on the website <https://www.frontiersin.org/research-topics/25070/modeling-and-numerical-simulations-with-differential-equations-in-mathematical-biology-medicine-and> and invitation was sent by email to about 200 academics. All submissions were subjected to rigorous peer-review process following the well-known policies and standards of Frontiers in Applied Mathematics and Statistics. Every submission was reviewed by two or three experts in the field.

In the following paragraphs, we give a short summary of the 10 published papers in that Research Topic.

[Appadu and Tijani](#) obtain the numerical solution of a 1D generalized Burgers-Huxley equation under specified initial and boundary conditions using Forward Time Central Space and a non-standard finite difference scheme. There are two proposed solutions and they show that only one is correct. Error analysis and convergence tests are performed.

[Attia \(A\)](#) models the progression of the non-alcoholic fatty liver disease (NAFLD) process by continuous time Markov chains with nine states. Maximum likelihood is used to estimate the transition intensities among the states.

[Mhlanga and Rundora](#) look at the existence and uniqueness of strong solutions to the Cauchy problem of stochastic equations. Sufficient and necessary conditions for existence

of a global positive solution of non-homogeneous stochastic differential equations with a non-Lipschitzian diffusion coefficient are obtained.

[Oukouomi Noutchie et al.](#) extends on the work of Jia and Qin on sexually transmitted disease models with a novel class of non-linear incidence. The existence, uniqueness, boundedness and positivity of solutions are established.

[Kehinde et al.](#) solve a two-dimensional semilinear singularly perturbed convection-diffusion problem. The approach requires linearization of the continuous semilinear problem using quasi linearization technique and nonstandard finite difference methods. Convergence tests are performed.

[Kinyili et al.](#) address the question of whether to drop or to continue wearing face masks especially after being vaccinated among the public. A deterministic mathematical model that takes into account vaccination program and wearing of face masks as intervention strategies is developed for COVID-19.

[Attia \(B\)](#) looks at the deleterious effects of obesity type II diabetes and insulin resistance, systolic and diastolic hypertension on the rate of progression of fibrosis in patients with non-alcoholic fatty liver disease (NAFLD).

[Agbavon et al.](#) obtain numerical solution for Fisher's equation using a numerical experiment with three different cases. The three cases correspond to different coefficients for the reaction term. The three methods are Forward Time Central Space, nonstandard and explicit exponential finite difference schemes. They determine if the optimal time step size is influenced by choice of the numerical methods or the coefficient of reaction term. Convergence tests are performed.

[Anwar et al.](#) construct mathematical model to understand viral dynamics within plants. They analyse the dynamics of two models of virus transmission in plants.

[Kwofie et al.](#) formulate a mathematical model to study crime dynamics and incorporate educational programs as a tool to assess the population-level impact on the spread of crime. The least square method is used.

Author contributions

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