

Report on the outcomes of a Short-Term Scientific Mission¹

Action number: **18232**

Grantee name: **Jasmina Đorđević**

Details of the STSM

Title: *Volterra type integrodifferential models for epidemics*

Start and end date: 10/07/2022 to 22/07/2022

Description of the work carried out during the STSM

We introduced new stochastic Volterra integrodifferential SEIRV (S-susceptible, E-exposed, I-infected, R-recovered, V-vaccinated) model for an epidemic of the corona virus SARS-CoV-2, causing the COVID-19 disease. We constructed the systems by complexity in two several steps; we supposed that the immunity gained by the recovery of the disease is not permanent, recovered individuals are returning in to class S after some period. Furthermore, we introduced the class of immunized individuals with the finite duration of immunity gained by vaccination. Our model is more realistic comparing to existing ones as it contains independent delays as distribution functions of random times describing the duration of incubation, infectiousness and immunity gained either by overcoming the disease or by vaccination. In addition, we purposed the classical Ornstein-Uhlenbeck process as a model for the transmission coefficient describing the exposure of individuals from susceptible class. For this particular SEIRV system the existence and uniqueness of the positive global solution is proven. Furthermore, the conditions for persistence of the disease in mean are derived. The theoretical results are illustrated via numerical simulations.

Description of the STSM main achievements and planned follow-up activities

In the collaboration with colleague from Osijek, we achieved to define the model with all complexities which we intended to introduce and prove several results (existence and uniqueness of positive solution, derive conditions for the persistence in mean and numerical illustrations). Next step is to derive the conditions for the extinction of the disease and illustrate it numerically.

Final goal is to collect the results in a manuscript, submitted into the journal and present it at future events. As the topic is in the scope of the action, this will contribute to the outcomes and deliveries of the action trough STSM.

¹ This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

We intend to continue this collaboration with between our sections, not only on this project but also in future projects within epidemical models.