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From Newton to COVID, via Riesz

Gergely Röst

Bolyai Institute, University of Szeged, Hungary
rost@math.u-szeged.hu

A famous anagram of Newton says that it is useful to solve differential equations. In this talk, I give an overview of how differential equations were used to fight COVID-19, by providing vital information to understand which factors are governing the transmission dynamics, to generate forecasts, and to plan rapid pandemic response. Many examples are taken from the work of the Hungarian COVID-19 Epidemiological Analysis and Modelling Task Force, which operated from March 2020 till March 2022, and then transformed into the National Laboratory for Health Security.

F. Riesz was one of the founders of the Bolyai Institute at the University of Szeged, who made fundamental contributions to functional analysis. Interestingly, some of his very theoretical results can give us significant insights into epidemiological dynamics as well, as I will illustrate in a case study.

In the last part, I show some of our results with Gabriella Vas (1983–2021) about the application of delayed relay systems in epidemic control.

The results presented in the talk are joint work with many colleagues.