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COVID-19 is a contagious epidemic caused by a novel coronavirus strain known as SARS-CoV-2, initially identified in Wuhan, China, on December 31, 2019. While numerous studies have been aimed at modeling and analyzing COVID-19 data in Indonesia, specific analyses tailored to the data available in Bekasi City remain limited. This research aims to determine the optimal values for the infection rate and recovery rate parameters and analyze the performance of the SIR model in Bekasi City. This study employs a different data collection approach compared to previous research, encompassing five months from January 5, 2022, to May 5, 2022. The SIR model simulates the spread of COVID-19 in Bekasi City. At the same time, the fourth order Runge-Kutta method is employed to compute differentiation values within the Susceptible-Infectious-Recovered Model (SIR Model), facilitating complex calculations that are challenging to resolve manually. Using the SIR model and the fourth order Runge-Kutta (RK4) method allows for examining infection spread dynamics in Bekasi City during the specified time frame. The obtained values for the infection rate and recovery rate are 1.163 and 0.912, respectively. These values result in a relative error value captured by dividing the root mean square error (RMSE) by the maximum value of the actual data, yielding 8.57%. This percentage indicates a satisfactory level of conformity between the model and the actual data, suggesting that the model demonstrates a relatively good fit to the observed data.

**Keywords :** COVID-19, model SIR, Runge-Kutta fourth order

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