## ABSTRACT

This study investigates the Varshni potential energy function $V$ in a numerical analysis framework. A linear first order ordinary differential equation satisfying only deterministic parameterisation is constructed and its general and particular solutions are obtained. Impact analysis is carried out on the model using numerical simulations, to investigate the sensitivity of the model parameters under external random perturbations, and the influence of these changes on the potential function. Four random perturbation configurations are studied in 15 scenarios each, with 15 iterations of numerical simulations run for each case, using a range of initial conditions. For each iteration, the effect of the perturbation on the potential levels is computed. The numerical algorithms are implemented with MATLAB, and Python is used to analyse and plot the results. The results of this study indicate that the potential strength is increasingly sensitive to increasing random perturbations, thus causing unpredictable fluctuations in the system. Further, higher initial values of the screening parameter result in lower curvatures in the potential curves. Computations of the p-vector norm errors between the two interacting solution trajectories of the potential model return values greater than zero and much less than 1, demonstrating that the model is trustworthy. This study concludes that variations in potential strength have direct differential effects on periodicity and instability of interacting potential systems, while variations in the screening parameter have direct influence on the shape of the curves. It is recommended that the methods employed in this research be extended to studying the effects of varying the range and iteration steps of the initial conditions, and the influence of computation time delays on the outcome of the simulations.