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A new approach to construct first integrals and closed-form solutions of dynamical systems for epidemics

A new class of non-standard Hamiltonian known as the "artificial Hamiltonian" is introduced which results in an artificial Hamiltonian system of first-order ordinary differential equations (ODEs). The notion of an artificial Hamiltonian is developed for the systems of dynamical systems of ODEs. Also, it is shown that every system of second-order ODEs can be expressed as an artificial Hamiltonian system of first-order ODEs. The newly developed notion of an artificial Hamiltonian system gives a new way to solve the dynamical systems of first-order ODEs or systems of second-order ODEs which can be expressed as an artificial Hamiltonian system by utilizing the known techniques applicable to the non-standard Hamiltonian systems. We employed this proposed notion to solve dynamical systems of first-order ODEs arising in epidemics.