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Dynamics and optimal control of a non-linear epidemic model with relapse and cure

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Highlights:

- We introduce the basic reproduction number for a general epidemic model with graded cure, relapse and nonlinear incidence rate in non-constant population size.
- We established that the disease free-equilibrium state E_f is globally asymptotically exponentially stable if $\Ro <1$ and globally asymptotically stable if $\Ro=1$.
- We showed the globally asymptotically stable of E_e under the condition $\Ro > 1$.
- We consider two types of control to reduce the number of infective individuals.
- We solved numerically the optimal control problem.