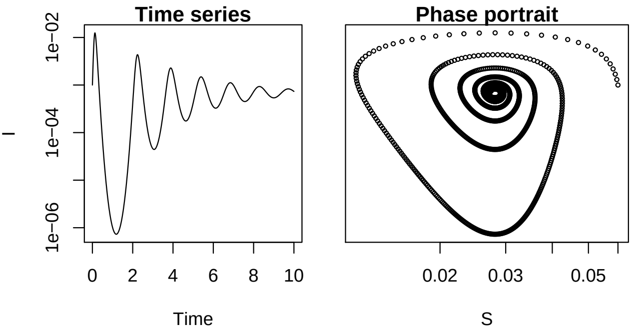
Numerical solution of deterministic epidemiological models

Introduction to ode and deSolve

John M. Drake & Pejman Rohani

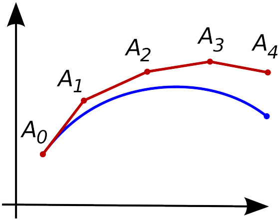
Boundary value problems

Typically, when we talk about "solving" differential equations we are talking about solving a *boundary value problem*: We want to start with a condition on the state variables (the *initial condition*) and inquire about the future values of the state variables as the system evolves over its *trajectory*.



Numerical integration

In general, this requires performing an integration. Typically, that integration is not analytically tractable. Numerical algorithms, such as the *4th order Runge-Kutta* algorithm take advantage of *Euler's approximation* to obtain an approximate solution by solving a sequence of (tractable) linear approximations at smaller and smaller step sizes until a specified tolerance is achieved.



Numerical solution of ODEs in R

In R, numerical integration of ordinary differential equations (including delay differential equations) is readily performed using the package `deSolve`.

Particularly, the function `ode` is useful since it automatically selects the optimal solving algorithm based on numerical performance.