

## [SIMIODE Resource Guide or Table of Contents](#)

### **Guide to Modeling Scenarios and Technique Narratives Organized as Traditional Table of Contents for Differential Equations Text**

This is a growing list of resources and as developed, refereed, edited, and finalized, new materials will be published.

- **Technique Narratives** are focused on solution strategies for differential equations, but with a motivational connection to a real-world situation.
- **Modeling Scenarios** are modeling driven activities motivated by rich detail and engagement in real world opportunities, often with data and model validation activities.

This Guide or Table of Contents is organized to follow the topics found in a traditional differential equations course, hence, the numbering system approximately reflects chapter sequencing in a standard differential equations text.

These materials are hyper-linked to [SIMIODE Publications](#) and they are available to all as Open Education Resources (OER) for adaptation and use in coursework with a request to acknowledge the source.

The link for each Publication takes the reader to a resource page which may have more than just the document.

Please use the Comments tab at each Publication to make suggestions, point to corrections needed, relate experiences in your use of the resource, upload further resources we will add to the resource, discuss technical materials, and share your thoughts on the material. These comments will go to the author and the SIMIODE editorial leadership.

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Making policy recommendations from models of spread of Ebola

### [6-016-PandemicModeling](#)

Modeling COVID-19 Pandemic with SIR Model and Geogebra

### [6-017-OncolyticViruses](#)

Explore oncolytic virotherapy using systems of differential equations

### [6-018-ExploringSIRModel](#)

Modeling rumor and disease spread

### [6-019-EnablingEpidemicExploration](#)

Several strategies for estimating parameters in models of epidemics

### [6-020-AlgaePopulationSelf-Replenishment](#)

Investigate the massive algal blooms that struck Lake Chapala, Mexico

### [6-021-AcornsRodentsSnakes](#)

Building a three trophic level model of acorns, rodents, and snakes

### [6-022-CannibalismPredatorPrey](#)

Analysis of predator-prey system with cannibalism feature added.

### [6-023-DroneHeadingHome](#)

Moving against a headwind create model of drone flight to fixed delivery point

### [6-024-DronePackageDelivery](#)

Describe the flight path of a drone delivering a package using numerical methods

### [6-025-WhalesAndKrill](#)

Use Excel to observe qualitative behavior a predator-prey model

### [6-026-IsleRoyaleModeling](#)

Population ecology to connect vector calculus and differential equations

### [6-028-SaltCompartments](#)

Amount of salt in two water tanks is modeled when tank volumes are changing

### [6-029-TumorGrowth](#)

An introduction to systems and tumor growth modeling

### [6-030-SaltAndTorricelli](#)

Modeling complex salt levels in a falling column of water

### [6-035-Shampoo](#)

Modeling the amount of shampoo in a bottle during a shower

### [6-040-StruggleForExistence](#)

Using historical data to model multiple species growth

### [6-045-CholeraTransmission](#)

Modeling of the Haitian cholera epidemic

### [6-065-InternetPlatformUsers](#)

Modeling the dynamics of Internet platform user's volume

### [6-067-LotkaVolterra](#)

Studying Lotka Volterra equations in integrated environment for R

### [6-068-VisualizingPredator-PreyCycles](#)

Nullcline analyses of predator-prey cycles

### [6-070-BeerBubbles](#)

Modeling the rise and size of beer bubbles in a sitting glass of beer

### [6-075-LorenzSystemSimulation](#)

Modeling the chaos of the Lorenz System with a physical simulation

## **Modeling Seven — Changing the Venue for Solution Success - Laplace Transforms**

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### [7-005-OverviewLaplaceTransform](#)

Introduction and application of Laplace Transforms

### [7-006-LaplaceTransformBirth](#)

Laplace Transform as the continuous analogue of a power series

### [7-011-CoupledSystemLaplace](#)

Using a baby warmer coupled system Laplace transforms are presented

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### [7-008-MachineReplacement](#)

Laplace Transforms - Convolution Applications - Replacement Theory

### [7-010-MultipleDoses](#)

Modeling several multiple dose approaches for drugs is considered

### [7-020-ThermometerInVaryingTempStream](#)

Study thermometer while sitting in a stream whose temperature oscillates

### [7-040-TankInterruptMixing](#)

Several approaches model flow of consecutive streams of salt into a container

## **Modeling Eight — Representing Natural Phenomena with Sines and Cosines**

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### [8-002-TrigSumRepresentation](#)

Representing functions as sums of trigonometric functions

## **Modeling Nine — Modeling with Differential Equations in Higher Dimensions**

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### [9-001-SkinBurnModelNumericalMethods](#)

Numerical methods for Heat Equation are introduced in context of skin burn issues

### [9-002-GroundWaterFlow](#)

Modeling groundwater flow and developing effective PDE models with data collection

### [9-005-InvasiveSpeciesModel](#)

Gentle progression from ODE to PDE modeling through invasive species model

### [9-010-TravelingWaves](#)

Modeling a traveling wave in porous medium

### [9-012-PDEGuitarTuning](#)

Tuning a Stringed Instrument with the Wave Equation

### [9-014-TurkeyCook](#)

Investigate several models for the cooking time for a turkey



[9-015-UnearthTruth](#)

Using electrical resistivity tomography to unearth tunnels

[9-020-HeatDiffusion](#)

Build equipment, conduct experiment, model data - has it all

[9-030-WaterHammer](#)

Modeling an initial-boundary value problem for the time evolution of a water hammer

[9-125-BeamModeling](#)

Modeling the deflection of a cantilever beam under two different distributed loads

[9-152-HorizontalBeam](#)

Modeling a suspended beam and collecting data to justify the model

**Modeling Ten — Modeling with Difference Equations**

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[10-001-TilingHallway](#)

Using tiling of hallways to motivate difference equation modeling

[10-100-InsectOutbreaks](#)

Modeling climate change effects on insect outbreaks