Calibration of System Dynamics models

- Calibration targets data
  - Kind
    - Time series
    - Area Under the Curve (AUC) numbers
  - Does the model have stocks that correspond to the calibration targets?
  - Assume that the calibration targets are modifiable to find the time units of the model
- Problems
  - Problem 1 (canonical)
    - Calibrate for Infected Population (IP)
    - Using SIR or SEIR
  - Problem 2 (model extension)
    - Calibrate for Deceased Infected Population (DIP)
    - Using both IP and DIP with weights
  - Problem 3 (prediction)
    - Calibrated with a portion of the data, and see does the model predict the rest
  - Problem 4 (lockdown policy)
    - Find the largest contact rate for which the deceased population is under a certain value
    - Assuming no hospitalizations are needed
- Formulation of the minimization problem
  - Calibration parameters
    - Rates
    - Stocks
  - Methods
    - Derivative free methods
    - Global minimum search combined with local minimum search
    - Random global minimum search
  - Distance functions
    - Euclidean distance
    - Calibration against parts of the target time series
    - Infinity norm
    - Sum norm
    - (Normalized) correlation
- Adding new model equations
  - To correspond directly to calibration targets data
  - Kind
    - Aggregation of an existing stock
    - “Monitoring” stock derivative with an algebraic equation
- Using more comprehensive models
  - E.g. using SEIR instead of SIR
- Utilizing solver’s monitoring abilities
  - Tracking stocks
    - WhenEvent
    - EvaluationMonitor
  - Using MVC/Observer Design pattern
- Large models
  - Assuming “large models” need days of computations to calibrate
  - Systematic progressive calibration
    - Calibration of ***representative*** simpler models
    - Parametrized generation of the model equations
    - Building confidence in the calibration workflow
  - Changing of equations representation
  - Low level solver features utilization
  - Monte Carlo methods