Why

We want to model natural phenomena.[1]

Definition

Let $X_0, X_1, \ldots, X_T$ be a sequence of sets and let $f_t : X_t \to X_{t+1}$ for $t = 0, \ldots, T-1$. We call $((X_0, \ldots, X_T), (f_1, \ldots, f_{T-1}$ a *deterministic discrete-time dynamical system.*

We call the index t the *epoch*, the *stage* or the *period.* We call X_t the *state space* at period t. We call f_t the *transition function* or *dynamics function.*

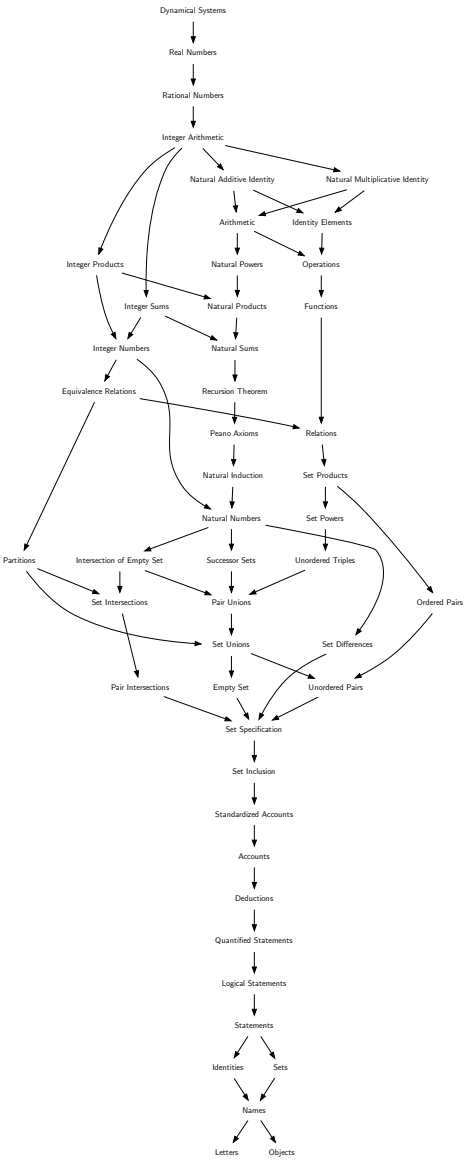
Let $x_0 \in \mathcal{X}_0$. Define a state sequence $x_1 \in \mathcal{X}_1, \ldots, x_T \in \mathcal{X}_T$ by

$$x_{t+1} = f_t(x_t, u_t).$$

In this case we call x_0 the *initial state.* We call the x_t the *trajectory* associatd with initial state x_0.

We call T the *horizon.* In the case that we have an infinite sequence of state sets, input sets, and dynamics, then we refer to a *infinite-horizon* dynamical system. To use language in contrast with this case, we refer to the dynamical system when T is finite as a *finite-horizon* dynamical system.

[1] Future editions will modify, and may develop dynamic systems via the genetic approach by appealing to their classical use in Newtonian physics for modeling celestial mechanics.


Dynamical Systems
Real Numbers
Rational Numbers
Integer Arithmetic
Natural Additive Identity
Natural Multiplicative Identity
Arithmetic
Identity Elements
Integer Products
Natural Powers
Operations
Integer Sums
Natural Products
Functions
Integer Numbers
Natural Sums
Equivalence Relations
Recursion Theorem
Peano Axioms
Relations
Natural Induction
Set Products
Natural Numbers
Set Powers
Partitions
Intersection of Empty Set
Successor Sets
Unordered Triples
Set Intersections
Pair Unions
Ordered Pairs
Set Unions
Set Differences
Pair Intersections
Empty Set
Unordered Pairs
Set Specification
Set Inclusion
Standardized Accounts
Accounts
Deductions
Quantified Statements
Logical Statements
Statements
Identities
Sets
Names
Letters
Objects