Systems, Signals, Input, Response

1 Introduction

How do we refer to previous documents in the same session? I'm deleting the "(4.2)"
here. – HB

In the bank example we modeled the amount in my account by:

$$\dot{x} - Ix = q(t).$$

Notice that the right-hand side does not depend on x. The left-hand
side represents what happens at the bank. The right-hand side represents
what comes into the bank. We will borrow the language of engineering to
describe the pieces of our model.

The left-hand side represents the **system** (the bank). The right-hand
side represents an outside influence on the system: it's a **signal** – the **input
signal**.

In general, a signal is just a function of t. Here it is the rate of sav-
ings. The system **responds** to the input signal and yeilds the function $x(t)$,
which we call the **output signal** or **system response**.

Solving the ODE means finding the unknown x. In this new language
it means finding the response of the system to the input signal $q(t)$.
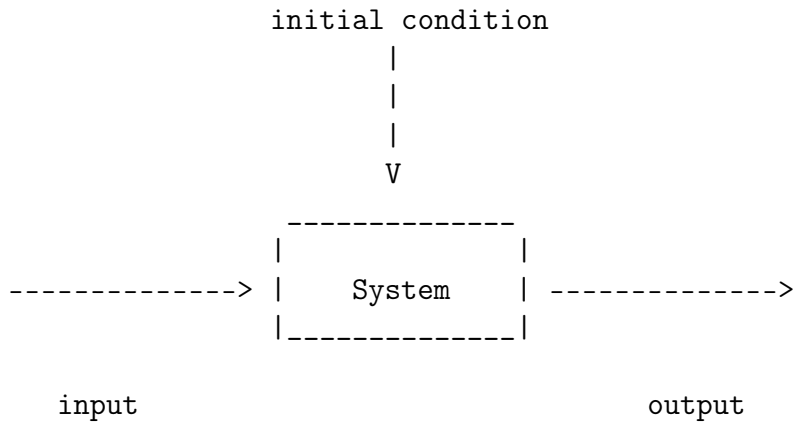

2 Block Diagrams

```
                          initial condition
                                 |
                                 |
                                 |
                                 |
                                 V
                          ---------------
                         |               |
         --------------> |    System     | -------------->
                         |_____|

              input                                output
```

Figure 1: Engineers use block diagrams to describe systems.

```
                               x(0)
                                |
                                |
                                |
                                V
                          ---------------
                         |               |
         --------------> |    Bank       | -------------->
              q(0)       |_____|         x(t)
```
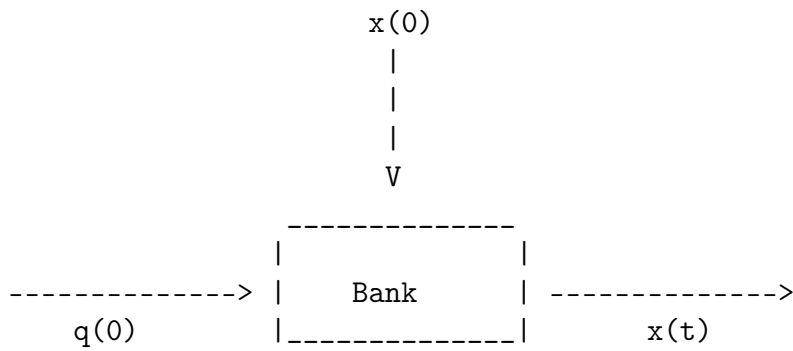
Figure 2: This diagram shows the input signal $q(t)$ and initial condition $x(0)$ going into the system and the output signal $x(t)$ coming out.