

# Handout 14: Introduction to nonlinear systems

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**Linear systems reminder:**

$y(u) =$

**main properties of linear dynamical systems**

**From transfer functions to ordinary differential equations:**

## Differential equations and physical systems

**Nonlinear systems: Examples**

**Nonlinear Pendulum**

**Chemical Reactions Kinetics:**

**(very) nonlinear mechanical systems: Rollercoasters**

**Case 1: Not linear at equilibrium**

**Case II: High sensitivity to initial conditions (not like linear systems)**

**"hard" nonlinearities**

**Dead zones**

**Saturations**

**”Bang Bang”**

**Backlash**

**Hysteresis**

**Dry Friction, Stiction, Stick-slip**