

In the name of God

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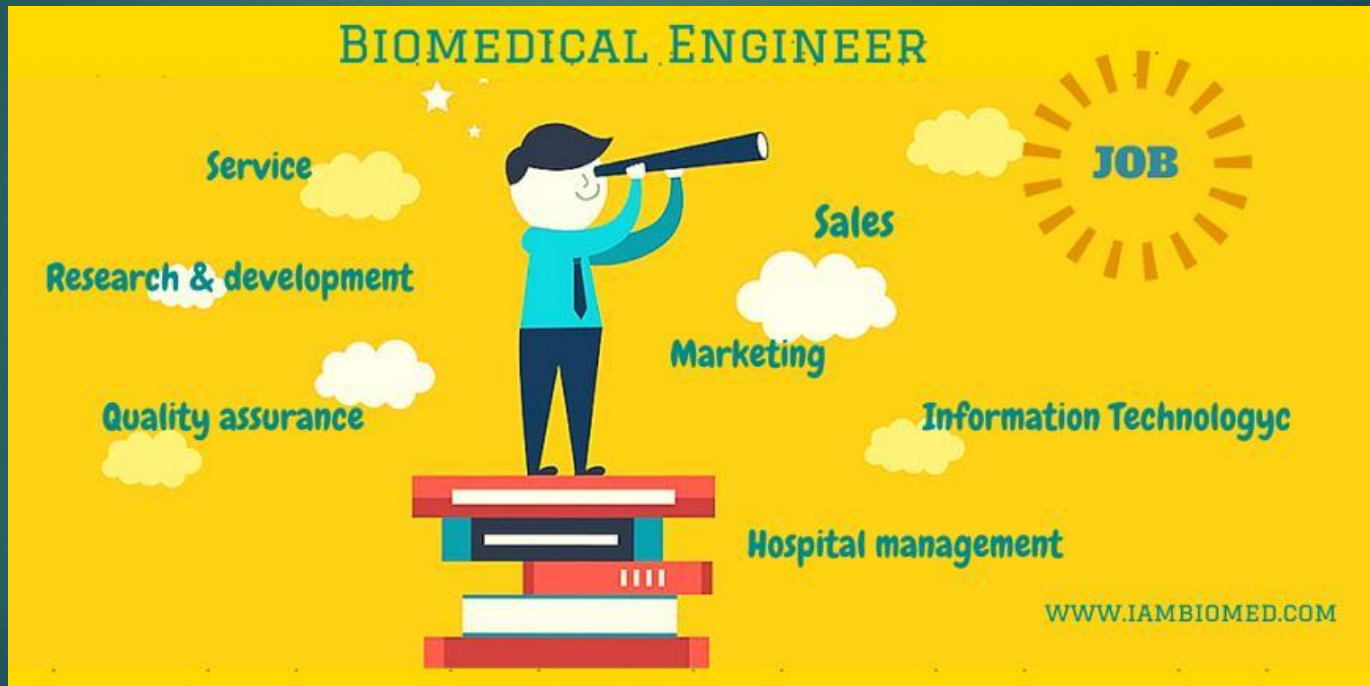
Modelling biological systems

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First important Question!

What is Biomedical Engineering?



Answer

1. Bio Medical Instrument.
2. Medical Image Analysis.
3. Biology Signals processing
4. Rehabilitation Strategies.
5. **Modeling Biology Systems.**
6. Engineering Cybernetics

Prerequisites for the course

- ▶ Signal analysis.
- ▶ Probability and Mathematical Statistics.
- ▶ Simulation with MATLAB software.

Syllabus

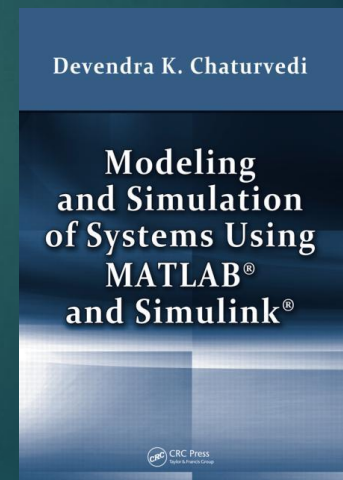
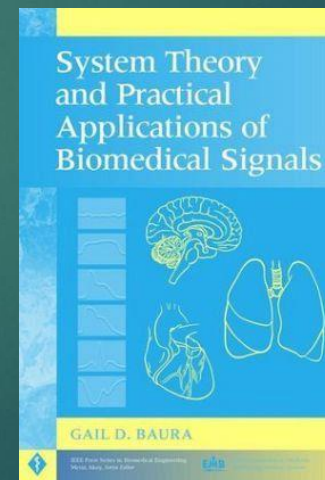
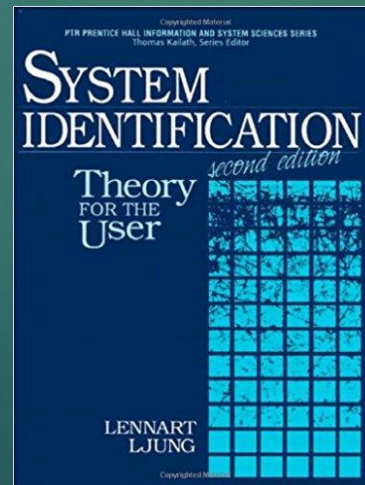
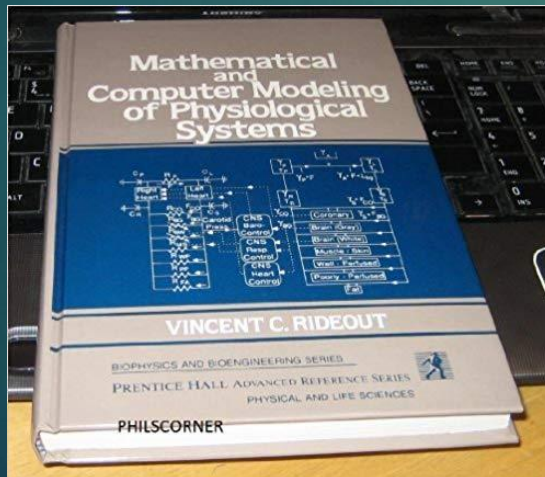
- ▶ **preface**
- ▶ **Introduction to System Modeling and Identification Theories**
- ▶ **Methods**
- ▶ **Pre-processing of data before modeling**
- ▶ **Choosing the right structure to evaluate the model**
- ▶ **Applications**
 - Cardiovascular system
 - Circulatory system
 - Respiratory system
 - Human musculoskeletal system & . . .
- ▶ **Chaos models**

Objectives and Goals

- ▶ System analysis.
- ▶ Controller Design and System Modelling.
- ▶ Prediction.
- ▶ Training.
- ▶ Reducing Construction and design Costs.

References

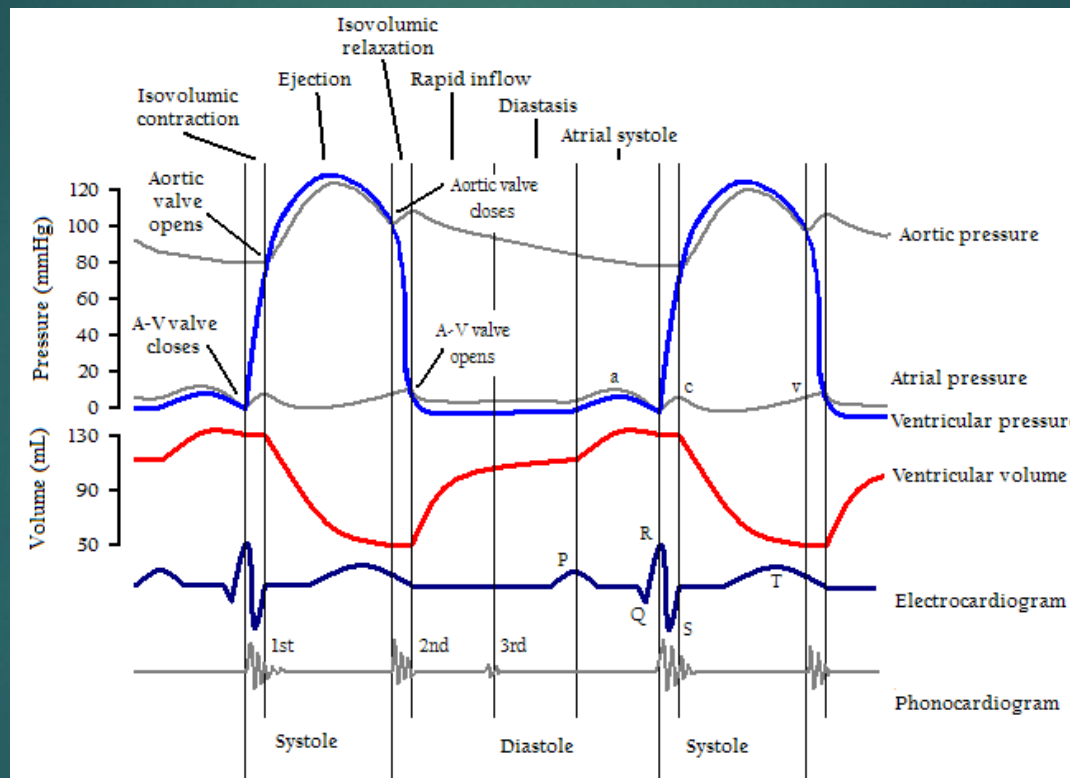
1. L. Ljung, “System Identification”
2. G. D. Baura, “ System Theory and Practical Applications of Biomedical signals”
3. V. C. Rideout, “ Mathematical and Computer Modeling of Physiological Systems”
4. Devendra K. Chaturvedi “Modeling and Simulation of Systems Using MATLAB and Simulink”
5. Various published papers
6. Using Courses related to Dr.Hashemi Golpayegani, Dr.Mahdi Azarnooh, Dr.Hamidreza Kobravi.



Students Evaluation

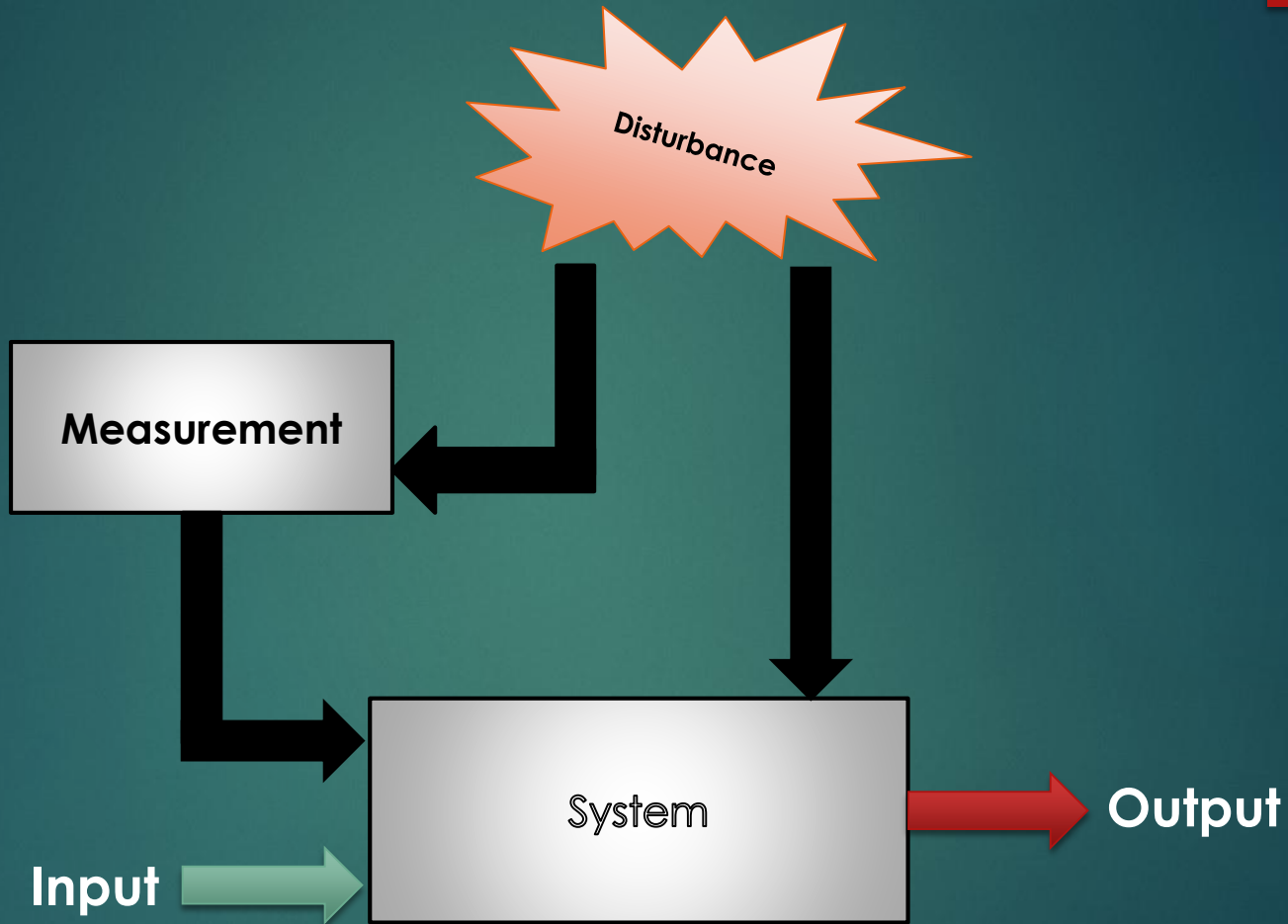
- Final exam 10 points
- Presentation 4.5 points
- Homework (Simulation projects) 5.5 points
- Submitting your accepted article 2 points **Extra**
- **It is important to understand that guidelines.**

What is Signal?



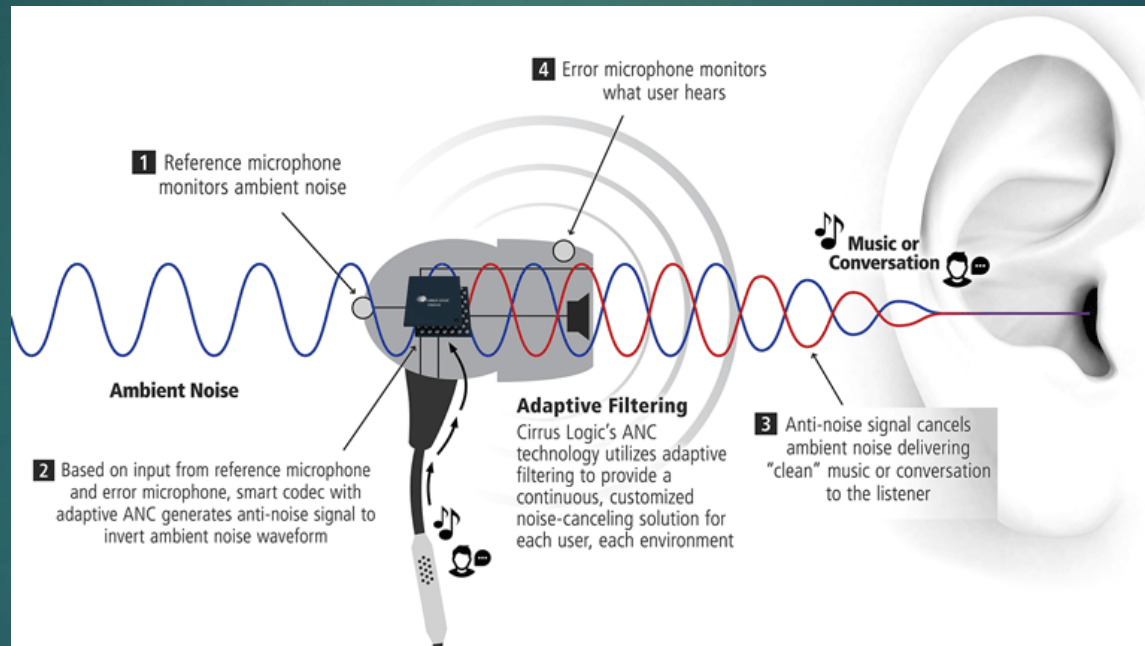
Types of inputs

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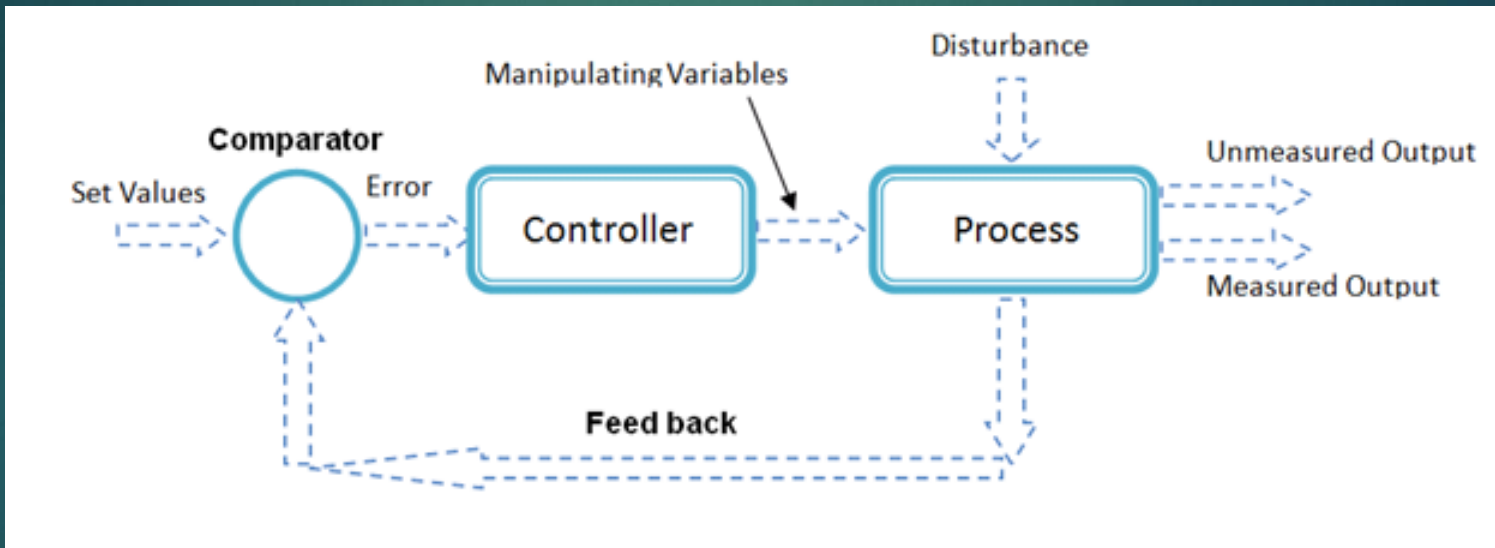
What is Disturbance?

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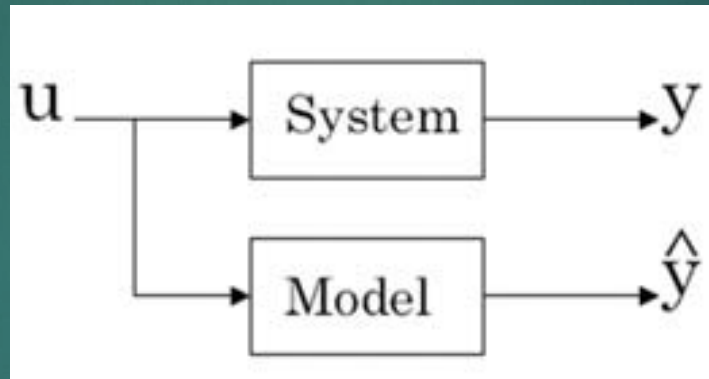


What is controller?

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What is Model?



Types of Models :

- ▶ Qualitative Model
- ▶ Physical Model
- ▶ Quantitative and symbolic model

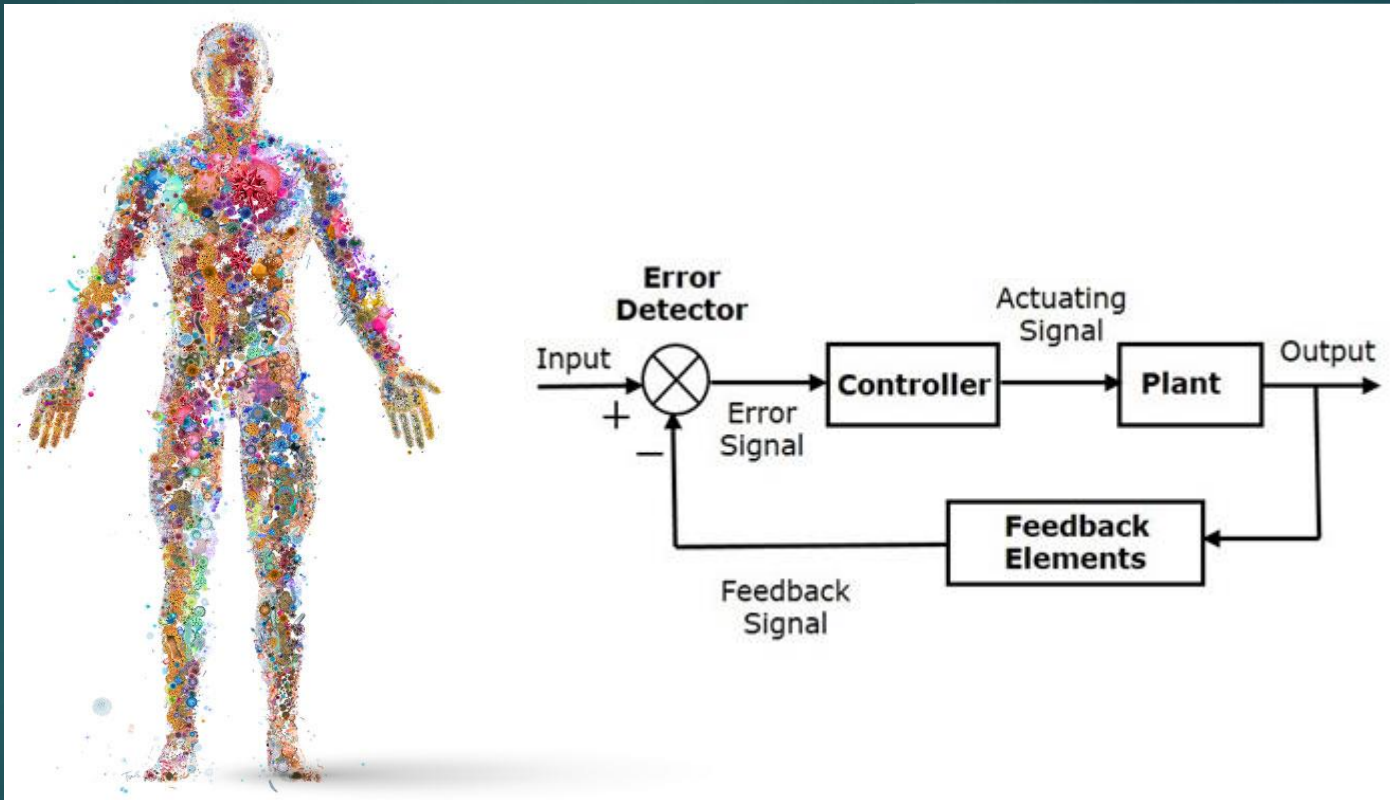


What is good Model?

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What is System?



Types of Systems :

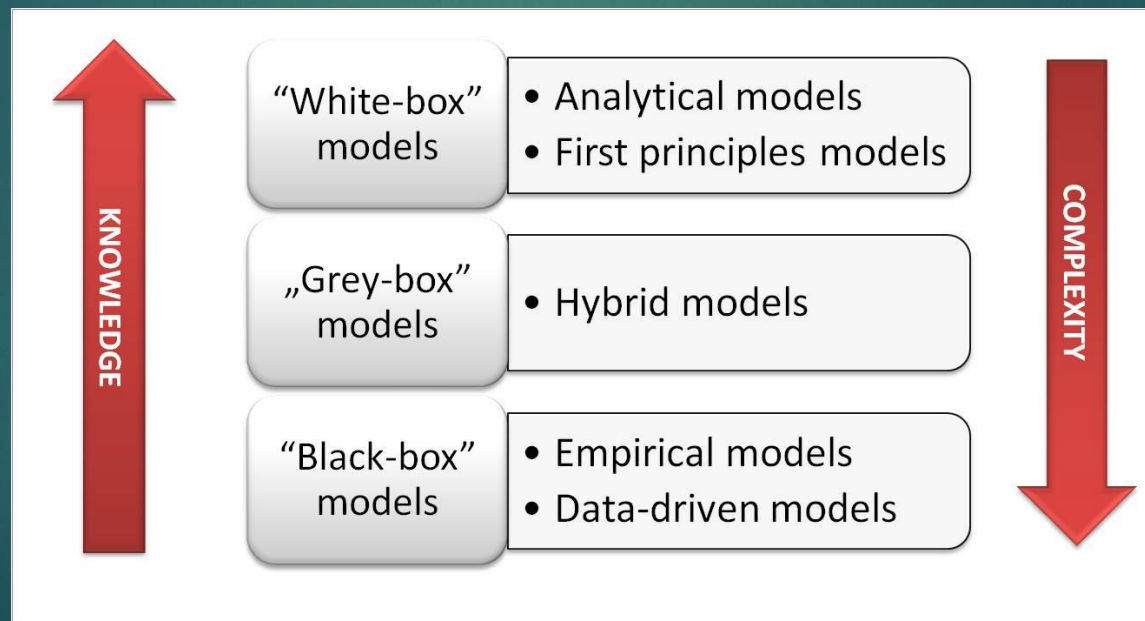
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- ▶ Static systems
- ▶ Dynamic systems
- ▶ Time variant
- ▶ Time invariant
- ▶ Linear
- ▶ Nonlinear
- ▶ Stochastic
- ▶ Deterministic
- ▶ Chaotic

Approach for systematic Modelling

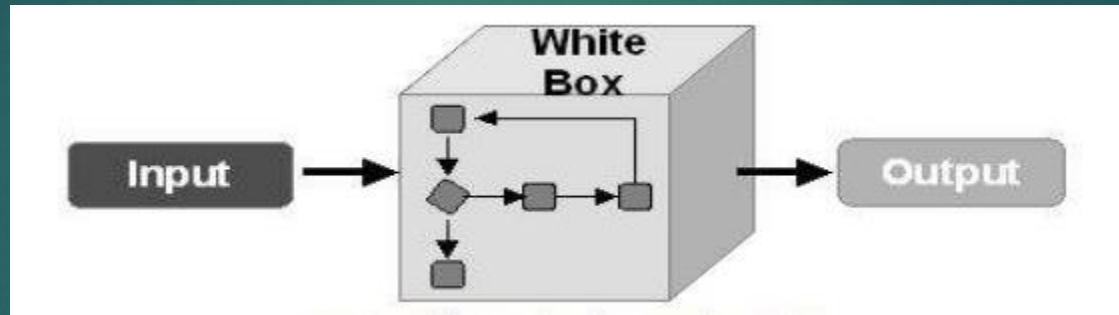
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- ▶ Analytical
- ▶ Experimental or system identification
- ▶ Compositional

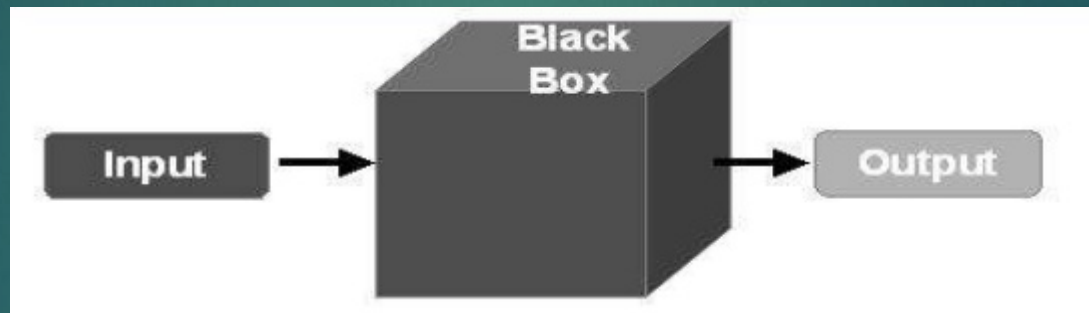


Analytical

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Experimental or system identification



Compositional



Why are models useful?

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contact us

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