Data and Mathematical Model Interoperability: Applications in Manufacturing Systems

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Objectives

- Systems design
- Real-time control
  - ⋆ Process control
  - ⋆ Scheduling — response to events

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Systems Design

Choose

- the processing machines,
- process parameters,
- inspection devices,
- material handling equipment, etc.

to meet target values of performance objectives,

- production rate,
- lead time, etc.

at minimal cost.

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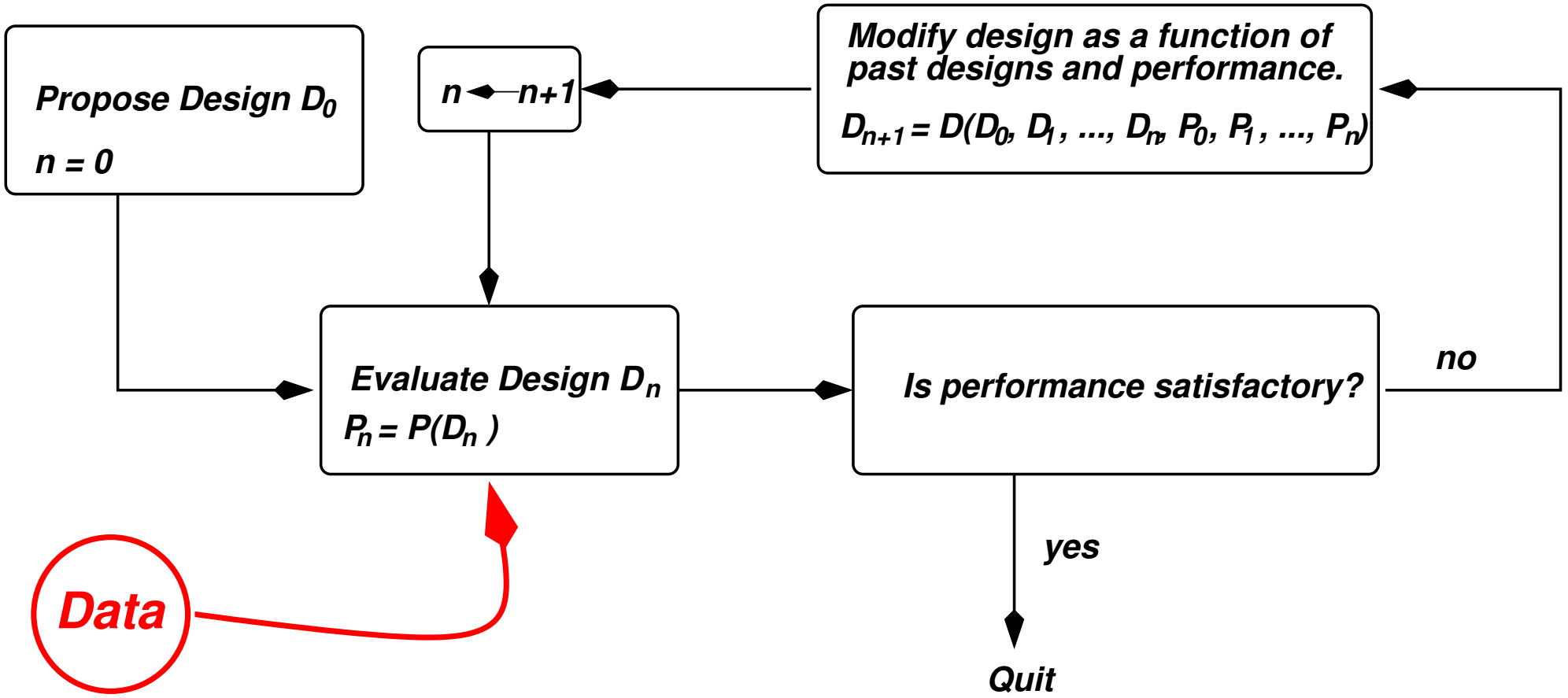
Systems Design



Systems Design

Parameters needed for design:

- capital cost
- inventory holding cost
- operation times
- MTTF, MTTR
- quality behavior (eg yield)
- setup times
- etc.

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Control

Respond to random events and anticipated process drift *in real time* to deliver the required product at the specified time with specified quality at minimal cost.

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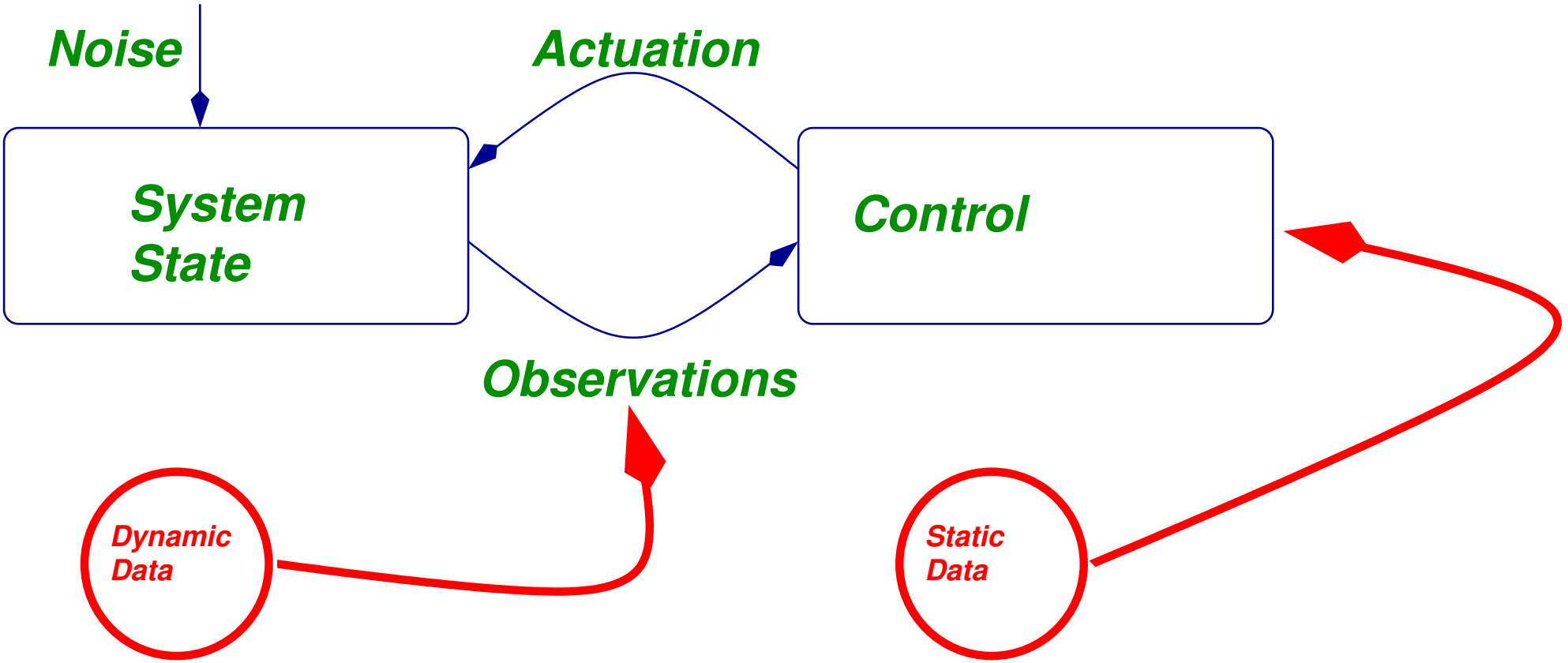
Control



Control

Data needed for real-time control (data *from* the factory):

- Machine operational status (operational, under repair, blocked, starved, setup, etc.)
- Machine usage data (times of recent maintenance, time and number of operations since last maintenance, etc.)
- Utilization levels
- Operator availability
- Inspection data (all measurements)

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Control

- Yield data (scrap or rework)
- Inventory levels (raw material, WIP, and finished goods)
- Orders and due dates
- Availability of tools and consumables

Some of this data *(suitably processed)* can be used to determine parameters for future factory design.

Control

Control actions (data *to* the factory):

- Part release
- Part dispatch (selection and routing)
- Part acceptance, rework, or scrap
- Process adjustment
- Maintenance initiation

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Current data difficulties

- Many factories are not instrumented.
- Data is often collected erratically and inconsistently.
- Many high tech factories (eg, semiconductor fabs) collect huge quantities of data but nobody looks at it.

Potential Benefits

If more or better data is made available, factories could be built and operated better:

- Less expensive
- Faster response times
- Improved quality

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SBG demo of cell1

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DLB demo of cell1

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Conclusions