Mathematical Models for Portability and Interoperability

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Introduction

- Monolithic models
- Modular models
- Input/output free modeling
- Portability & Interoperability
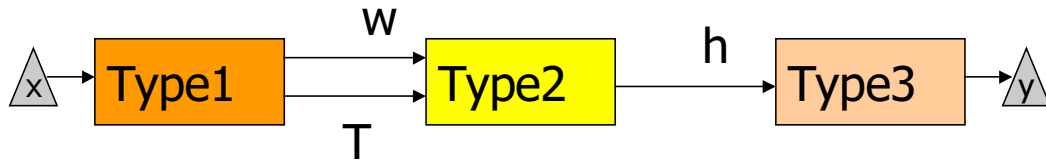- Equation based implementations

Monolithic Models

- DOE-2, BLAST, TRACE
- Characterized by:
  - Fixed set of options that are difficult to change
  - Select from menu to express system arrangement
  - Specify sizes and capacities
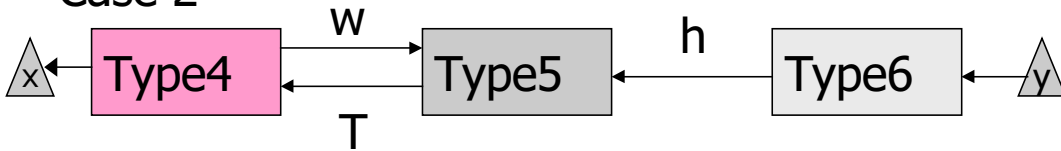 - Efficient, easy to use

Modular Modeling

- TRNSYS AND HVACSIM+
- Characterized by:
  - **Subroutine** based, **directional** modules
  - **Directional** interconnection language
  - **Nonhierarchical**
  - Extendable library
  - Numerically challenging

Modular Example 1

•Case 1

```
  x → [ Type1 ] --w--> [ Type2 ] --h--> [ Type3 ] → y
                T
```

•Case 2

```
  x ← [ Type4 ] <--w-- [ Type5 ] <--h-- [ Type6 ] ← y
                T
```
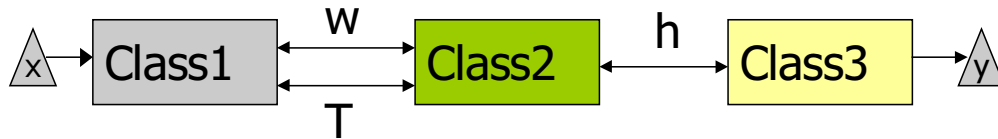
•Same physical models, *different modules*

Equation Based Modeling

- SPARK and IDA
- Characterized by:
  - **Equation** based, **nondirectional** classes
  - **Nondirectional** interconnection language
  - **Hierarchical**
  - Extendable library
  - Numerically challenging

Equation Based Example 1

- Case 1

- Case 2

- Same physical models, *same classes*

Portability

- **Your** model implementation works in **my** simulation environment.
- Model **translation** will be required.
- **Equation** based models help:
  - Single nondirectional implementation
  - Easier to translate that algorithms

Interoperability

Interoperability => portability

Equation Based Implementations

- SPARK
- IDA
- NMF