Generative Modeling and Numerical Optimization for Energy Efficient Buildings

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Generative Modeling

− no list of primitives
   (triangles, NURBS, etc.)

+ algorithms and programs
   with operations
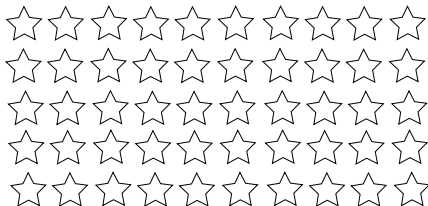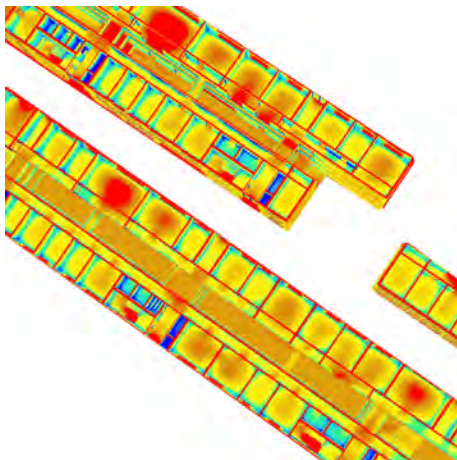
```
MoveAbs 25,25
Loop 5 {
   Loop 10 {
     Loop 5 {
        Rotate -54
        Draw 5
        Rotate 126
        Draw 5
     }
     Move 20 -1
   }
   Move -210,20
}
```

Generative Modeling

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```
MoveAbs 25,25
Loop 5 {
   Loop 10 {
     Loop 5 {
       Rotate -54
       Draw 5
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     }
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Energy Efficient Buildings

Numerical Optimization

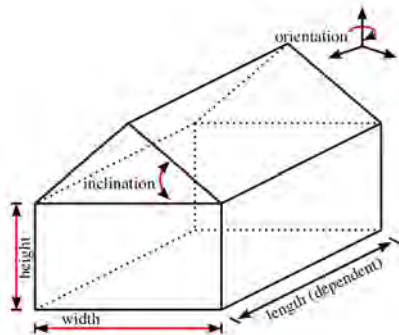Each generative / procedural model consists of:

1. an algorithm resp. a script
   ```
   createModel(...)
   ```
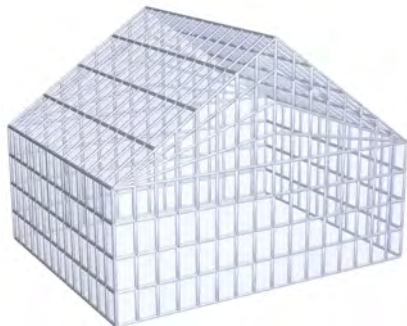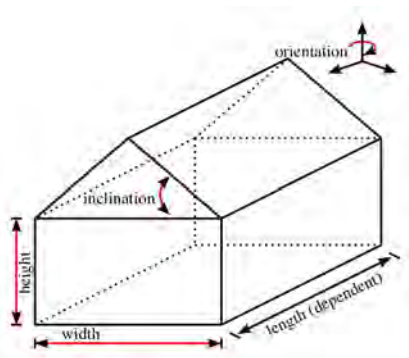   and

2. some parameters
   ```
   createModel( 12.0, 4.23, 63.87, 89, 32.56 )
   ```
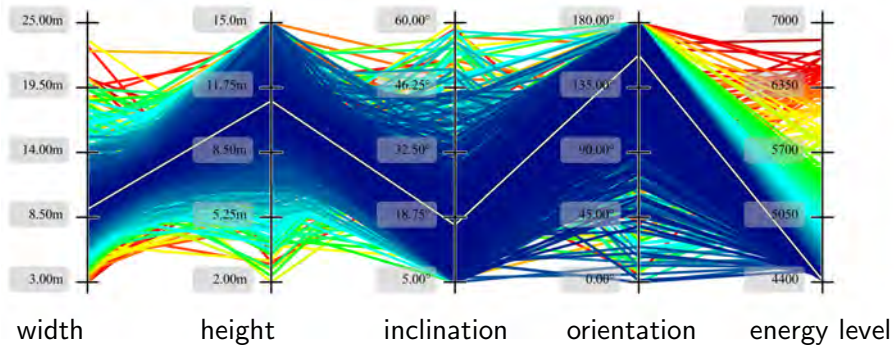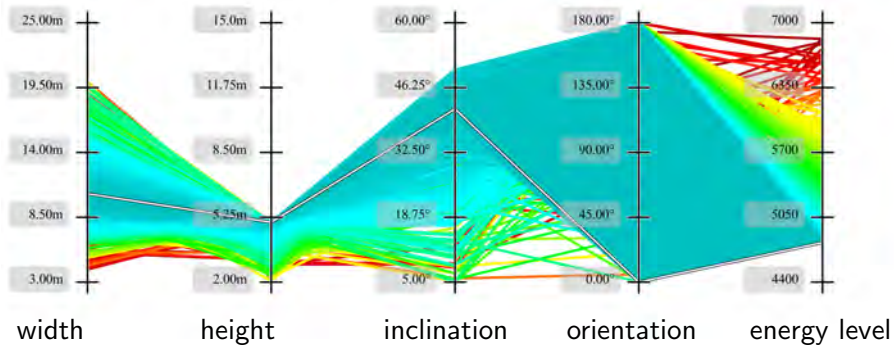
Examples: Greenhouse No. 1

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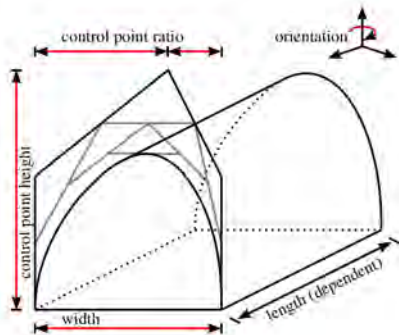
Examples: Greenhouse No. 1

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width   height   inclination   orientation   energy level
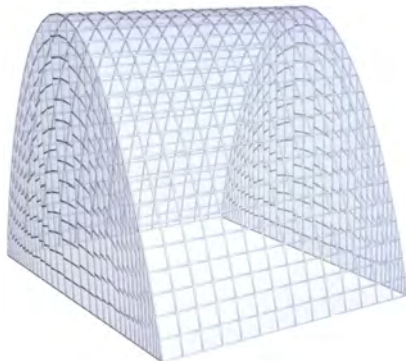
Examples: Greenhouse No. 2

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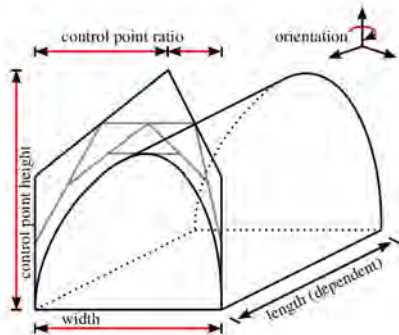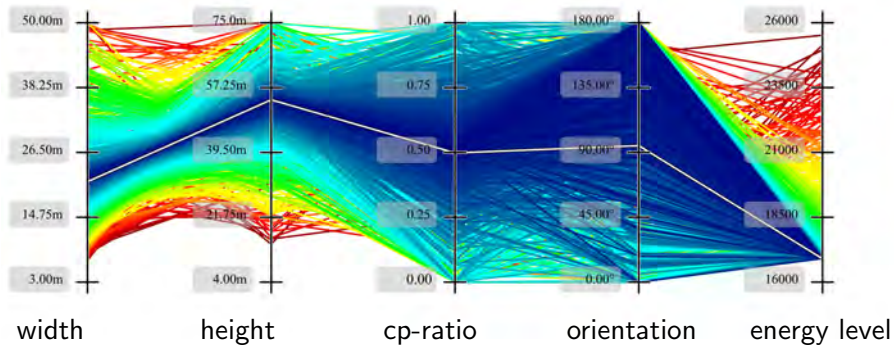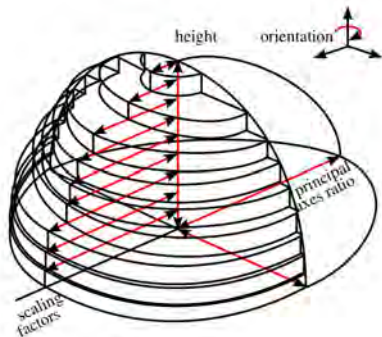

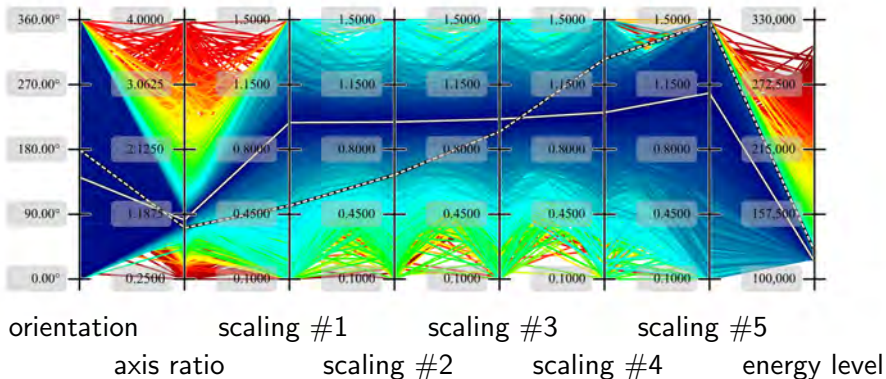width   height   cp-ratio   orientation   energy level

Examples: Office Building

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orientation   scaling #1   scaling #3   scaling #5

    axis ratio   scaling #2   scaling #4   energy level

Conclusion

Contribution:

- separation of design & functionality
- interdisciplinary approach

Benefit:

- functional optimization
- design space exploration