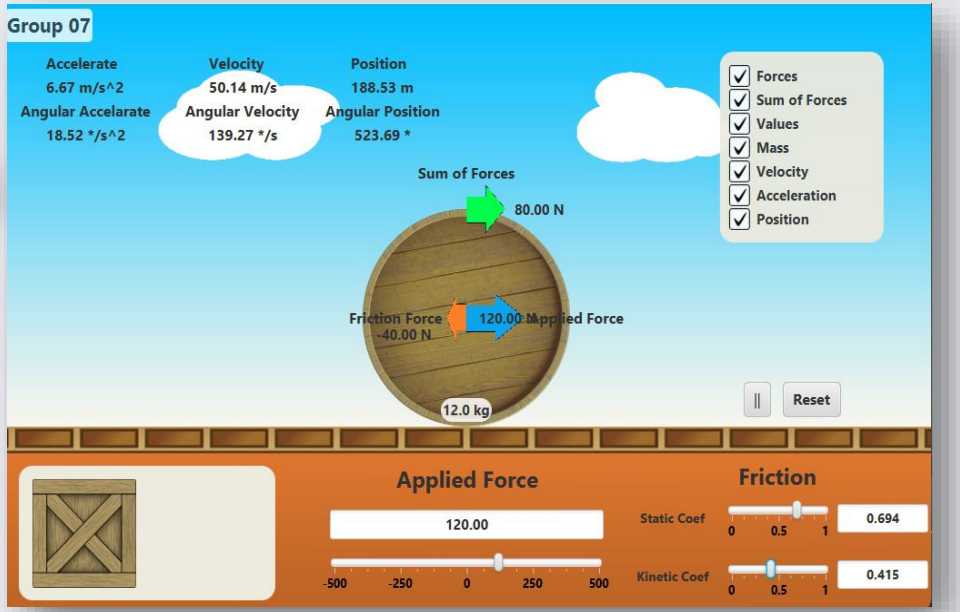
Interactive simulation of the composition of forces



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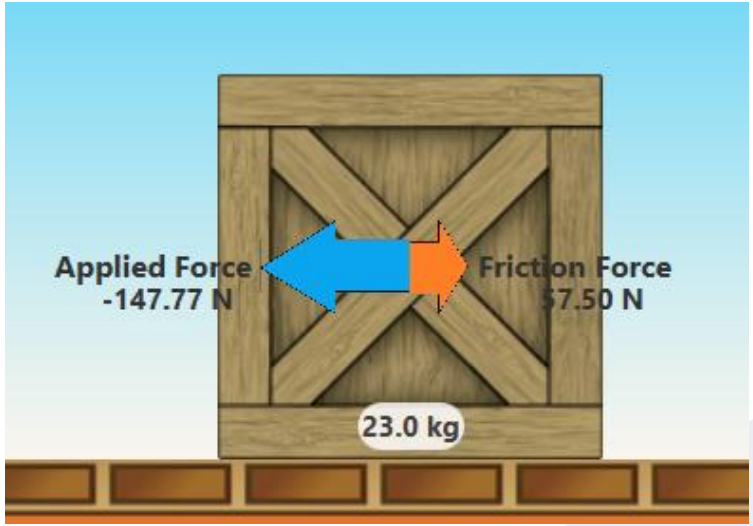
Problem statement

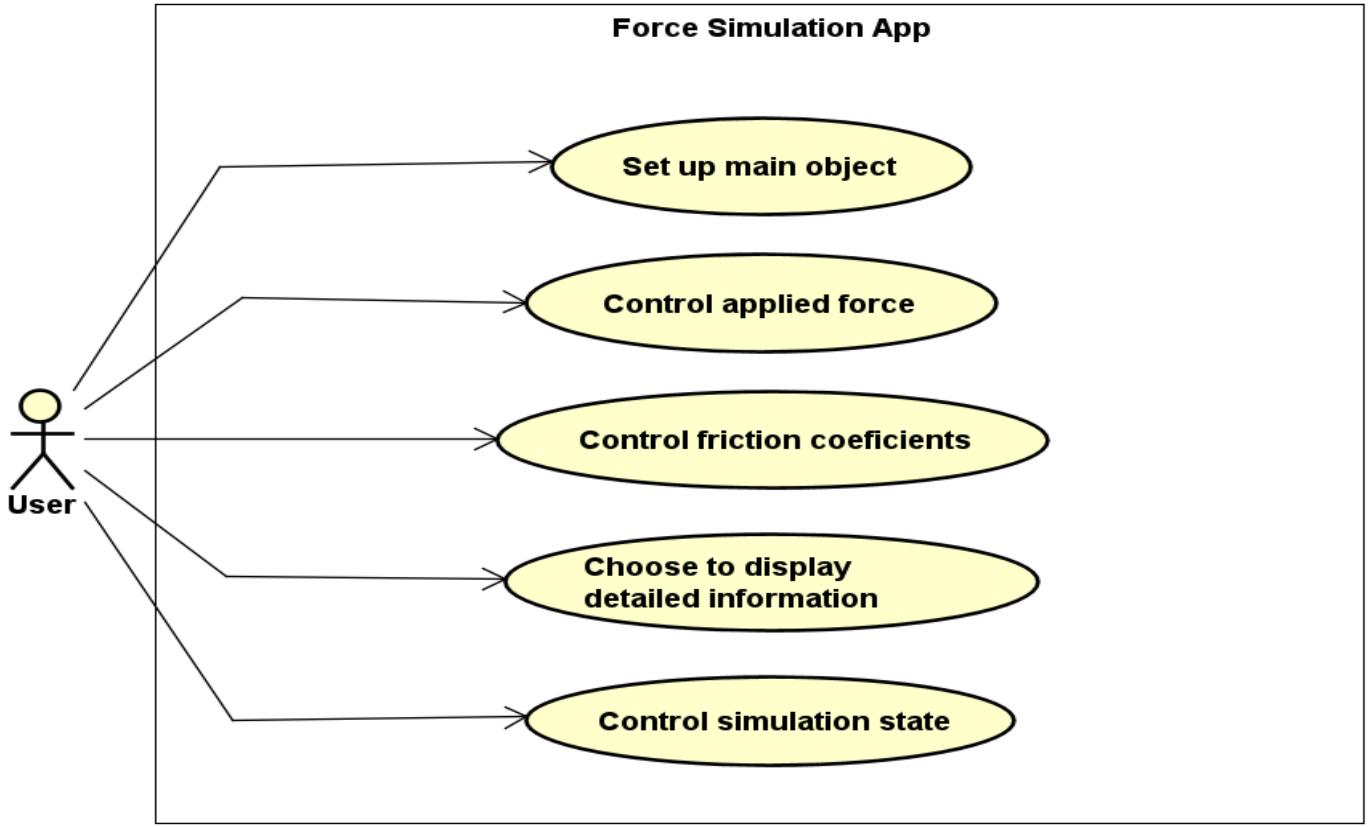
Simple interactive simulation:
-> Newton’s laws of motion

User:
- Control all components
- Observe motion of main object
- Display statistics: velocity, acceleration, force value, …

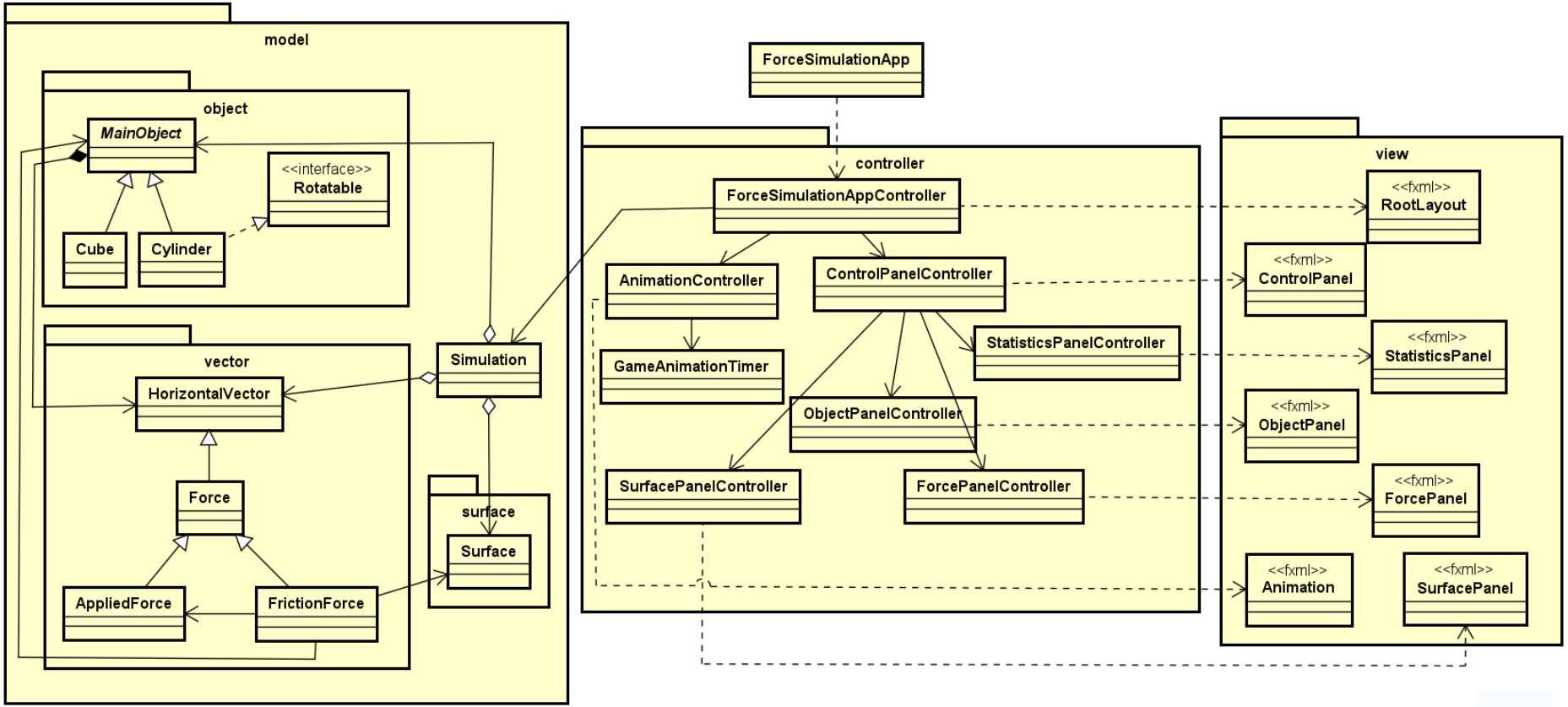
System: Recalculate statistics each time interval



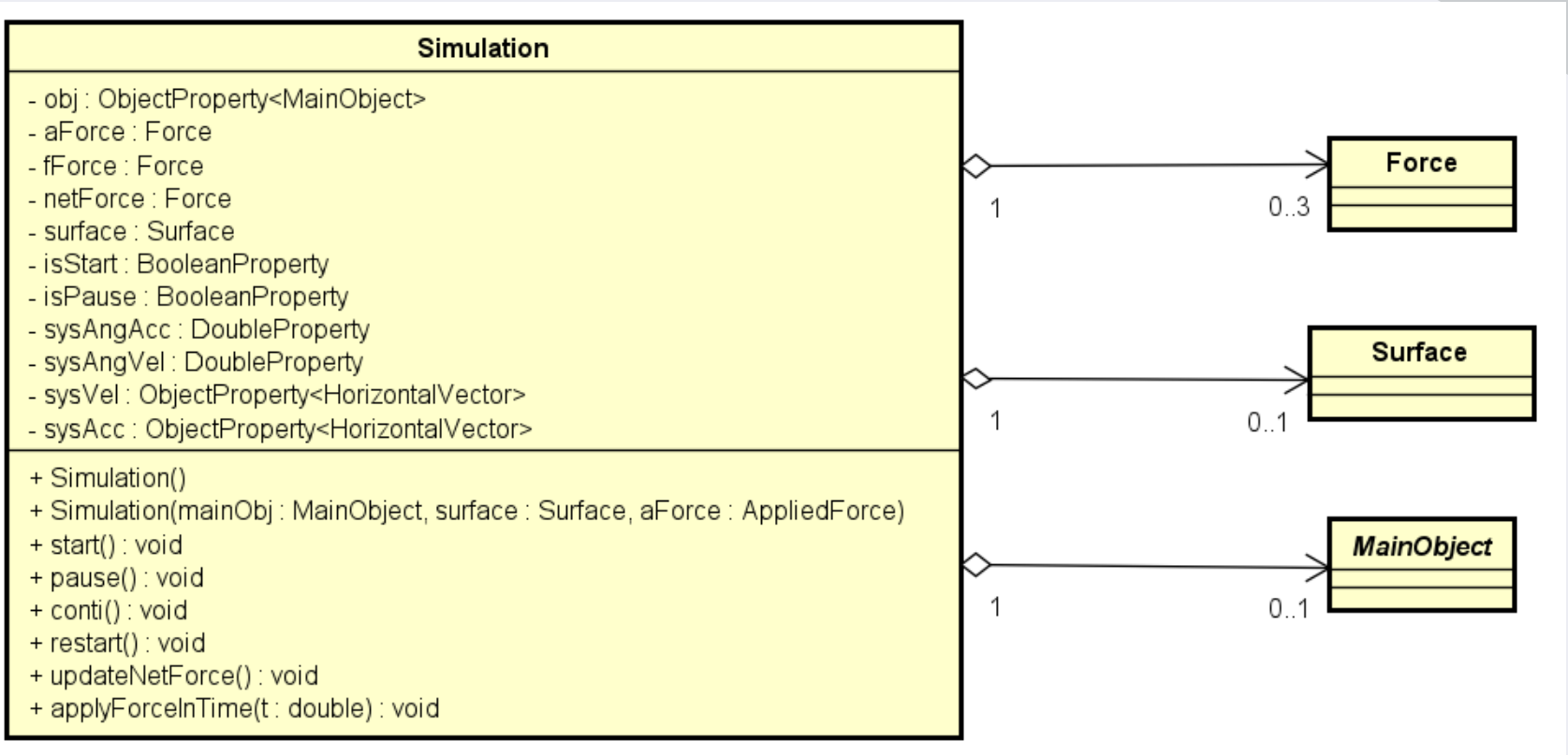
Use case diagram



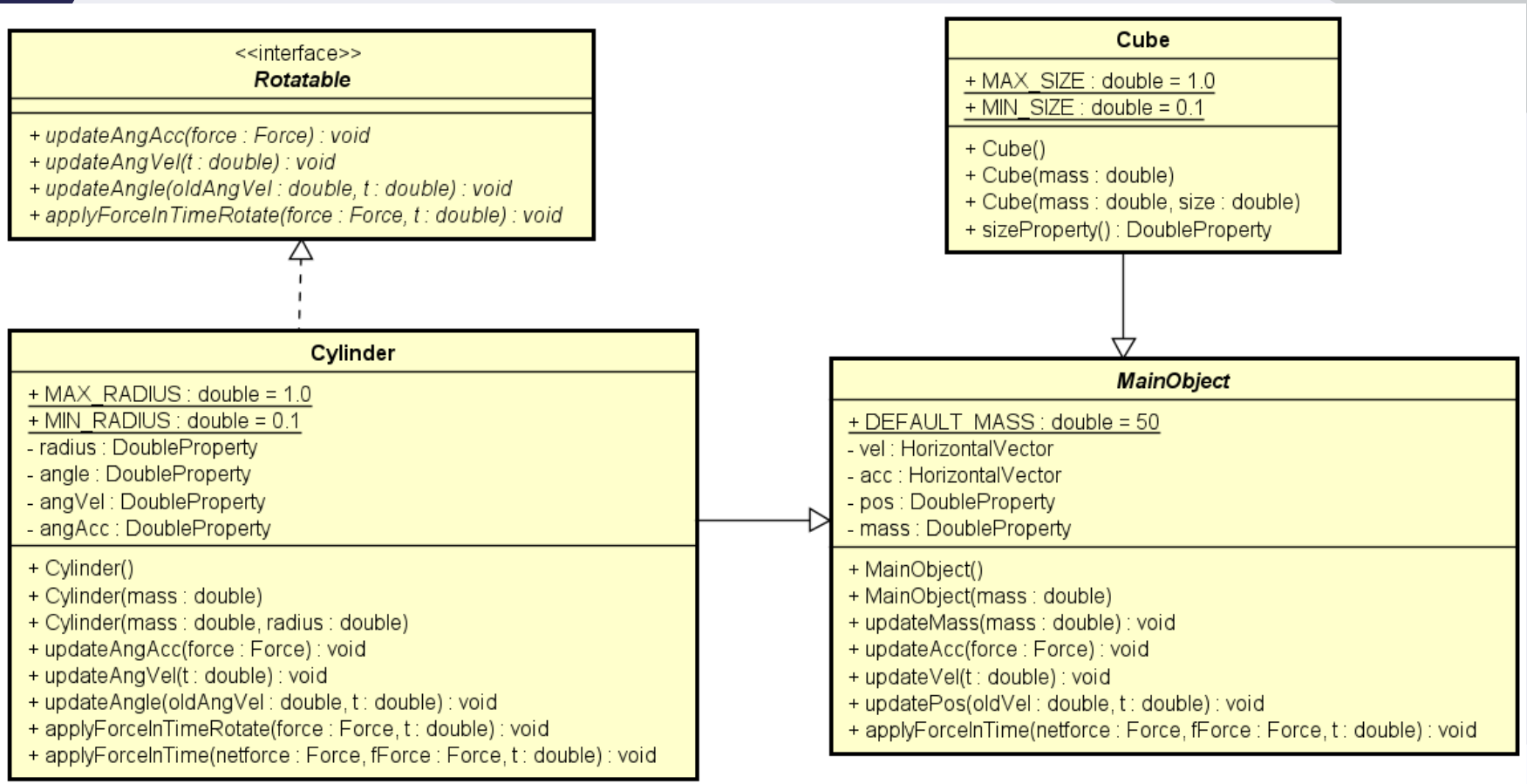
General class diagram



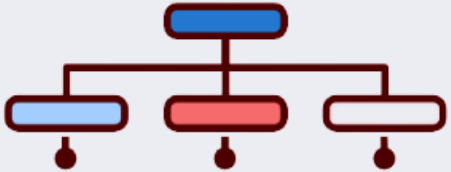
Class diagrams for model package



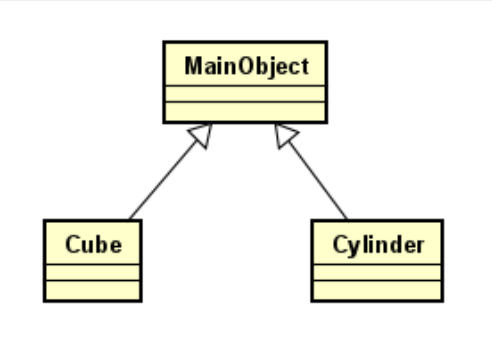
Class diagrams for object package



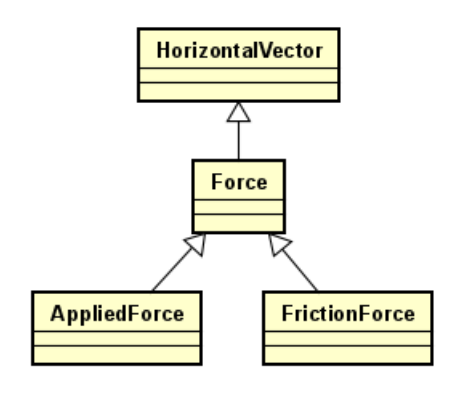
Inheritance



Cube, Cylinder inherits from MainObject



All Forces inherits from HorizontalVector



Polymorphism

Different behaviors *applyForceInTime*

In Simulation class:

```
public void applyForceInTime(double t)
{
    this.getObj().applyForceInTime(…);
}
```

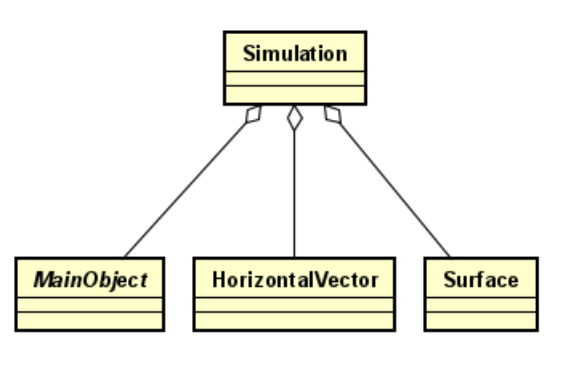
In Cube class:

```
public void applyForceInTime(..) {
        super.applyForceInTime(..);
}
```

In Cylinder class:

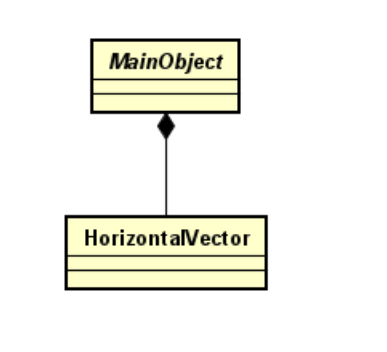
```
public void applyForceInTime(..) {
        super.applyForceInTime(..);
        this.applyForceInTimeRotate(..);
}
```

Aggregation



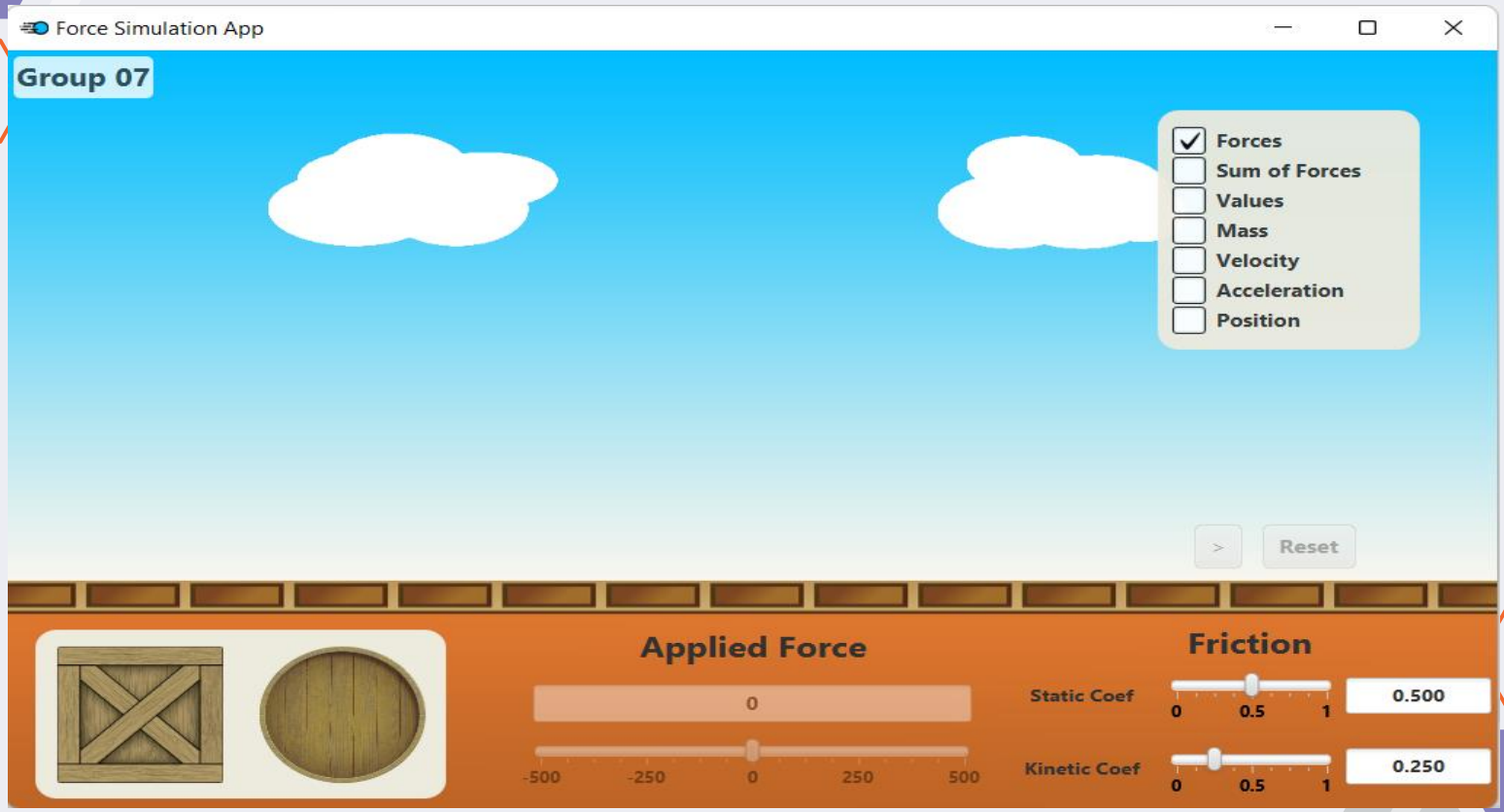
Simulation aggregates MainObject, HorizontalVector , and Surface

Composition



MainObject composites HorizontalVector (such as velocity, ..)

Demo



https://youtu.be/NiNDOvTOK9c