Electrical circuit simulator

20194436 Nguyen Duy Hung

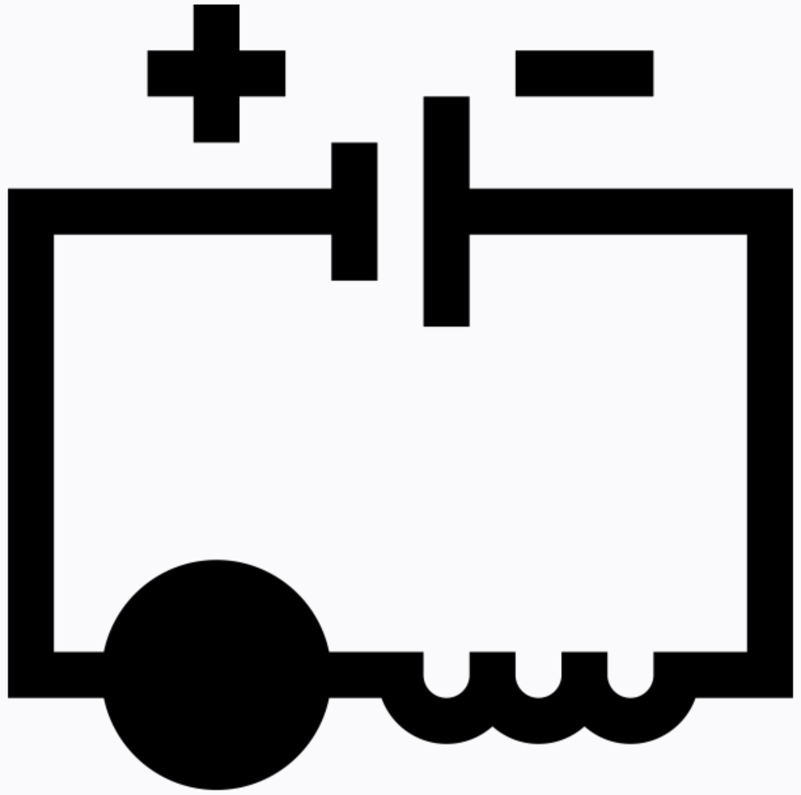
- Design GUI

20194448 Nguyen Hoang Nhat Quang

- Set initialization

20194449 Le Hai Son

- Report and design diagram



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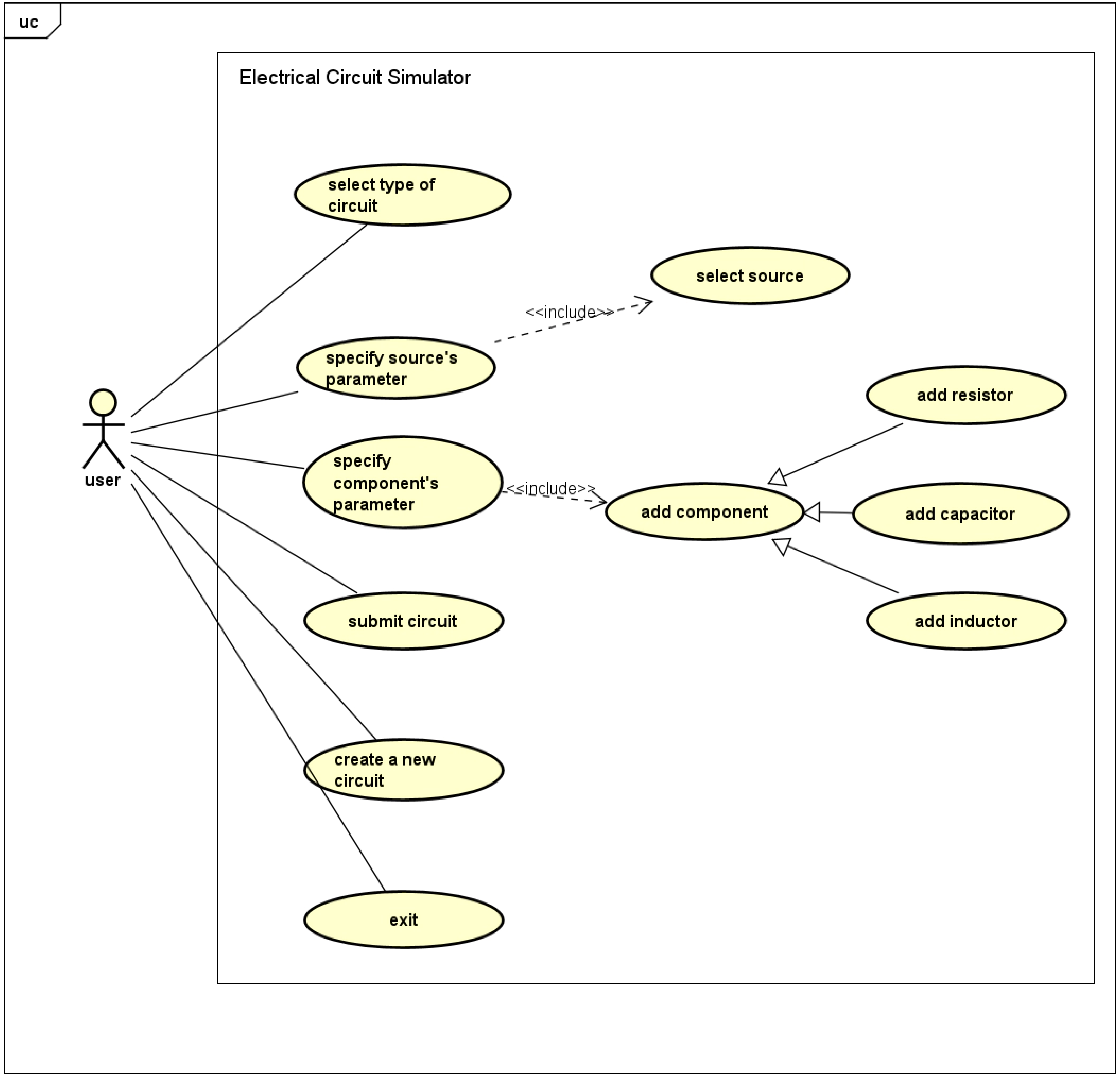
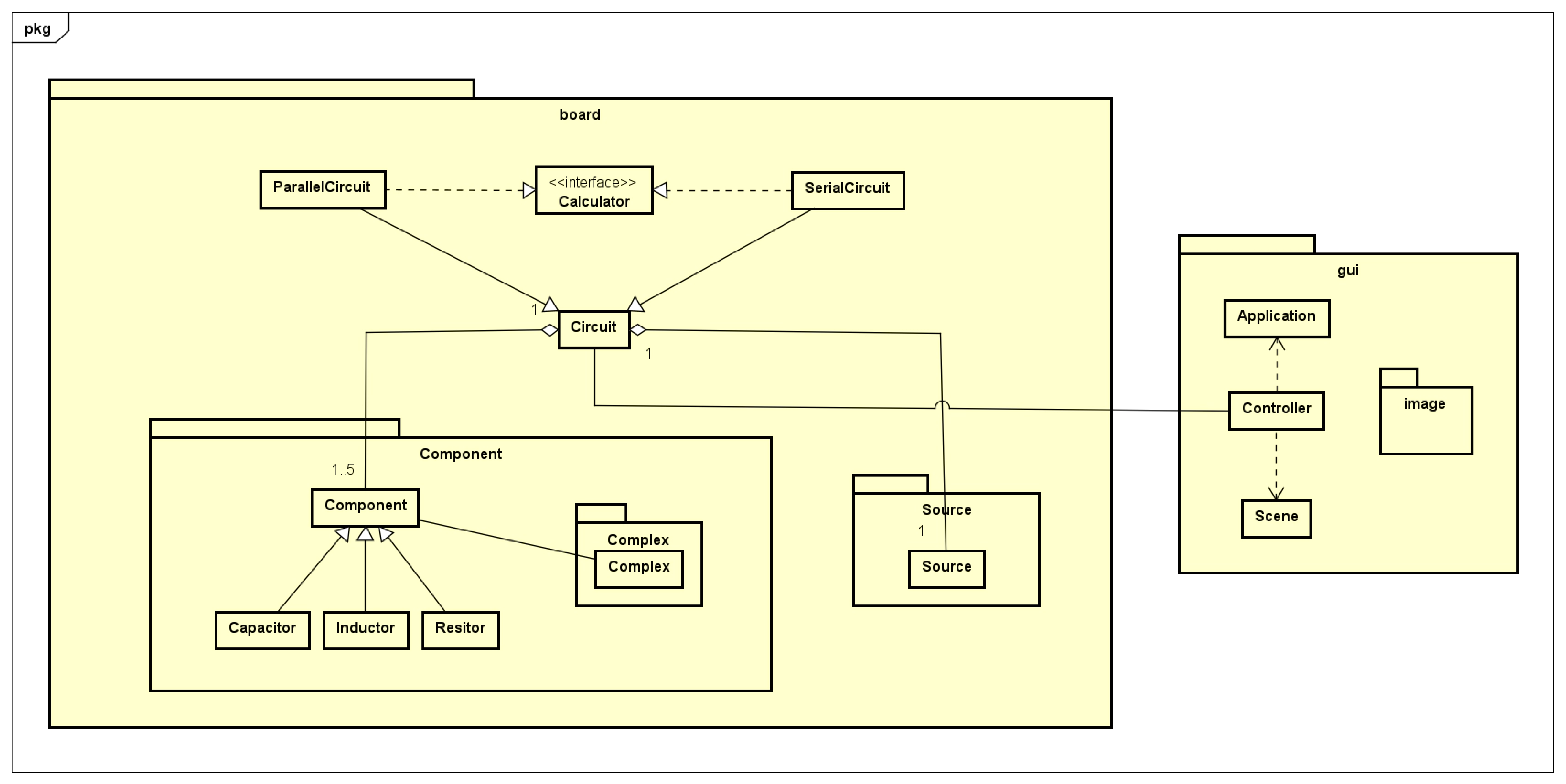
Problem statement

- Build an electrical circuit and perform circuit analysis on it
- Pick a type of circuit (parallel circuit and serial circuit)
- Select a type of source (AC and DC) and input parameter (V, Hz)
- Add component (resistor, inductor, capacitor) and input parameter (Ω, L, C)
- Press submit to view analysis sheet and circuit diagram
- Create a new circuit
- Exit

Use case diagram

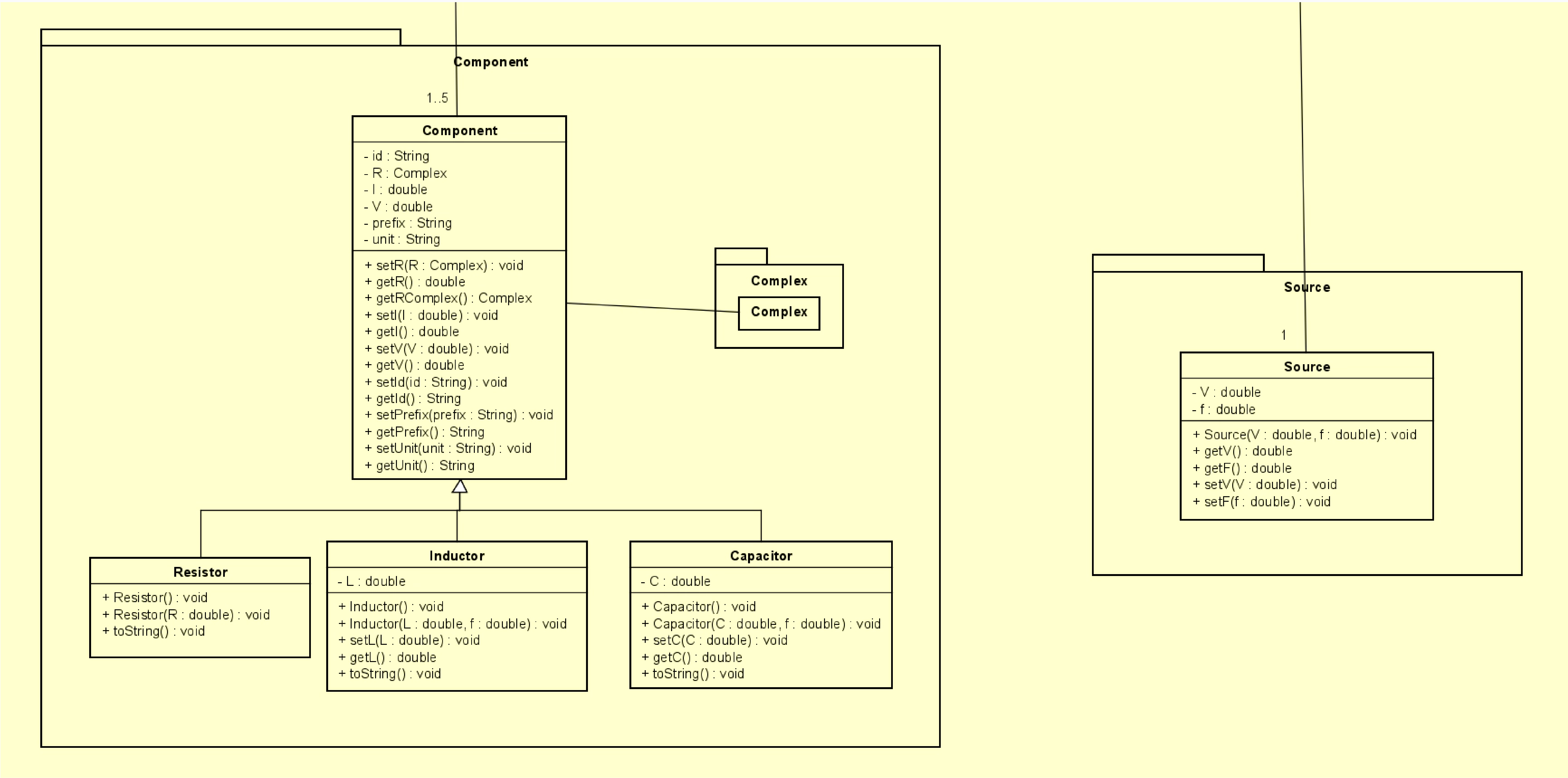


General class diagram



Class diagrams for packages

component and source



```
Component
- id : String
- R : Complex
- I : double
- V : double
- prefix : String
- unit : String
+ setR(R : Complex) : void
+ getR() : double
+ getRComplex() : Complex
+ setI(I : double) : void
+ getI() : double
+ setV(V : double) : void
+ getV() : double
+ setId(id : String) : void
+ getId() : String
+ setPrefix(prefix : String) : void
+ getPrefix() : String
+ setUnit(unit : String) : void
+ getUnit() : String
```

```
Complex
```

```
Resistor
+ Resistor() : void
+ Resistor(R : double) : void
+ toString() : void
```

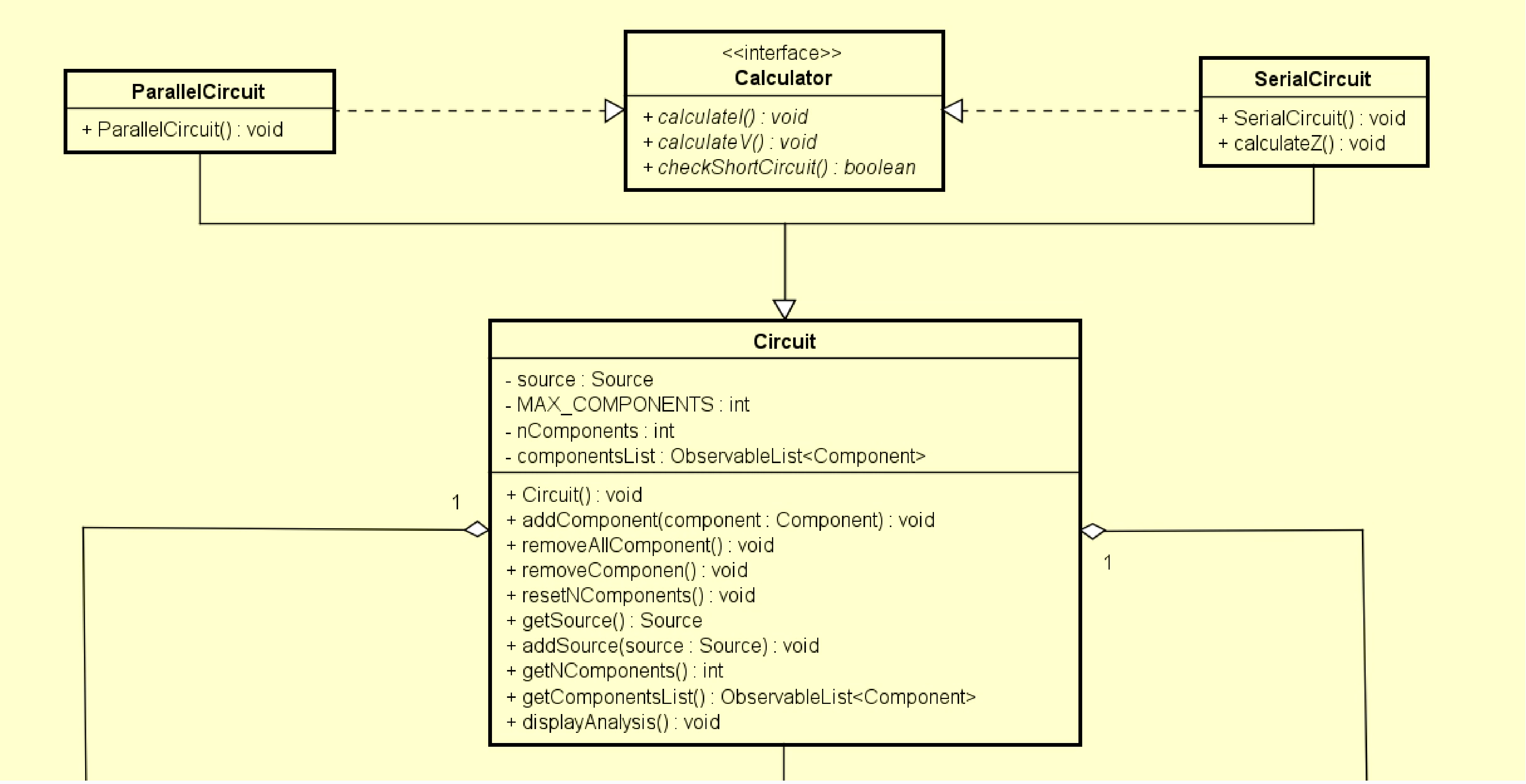
```
Inductor
- L : double
+ Inductor() : void
+ Inductor(L : double, f : double) : void
+ setL(L : double) : void
+ getL() : double
+ toString() : void
```

```
Capacitor
- C : double
+ Capacitor() : void
+ Capacitor(C : double, f : double) : void
+ setC(C : double) : void
+ getC() : double
+ toString() : void
```

```
Source
- V : double
- f : double
+ Source(V : double, f : double) : void
+ getV() : double
+ getF() : double
+ setV(V : double) : void
+ setF(f : double) : void
```

Class diagrams for packages

board and gui



ParallelCircuit

+ ParallelCircuit() : void

<<interface>>
Calculator

+ *calculateI() : void*
+ *calculateV() : void*
+ *checkShortCircuit() : boolean*

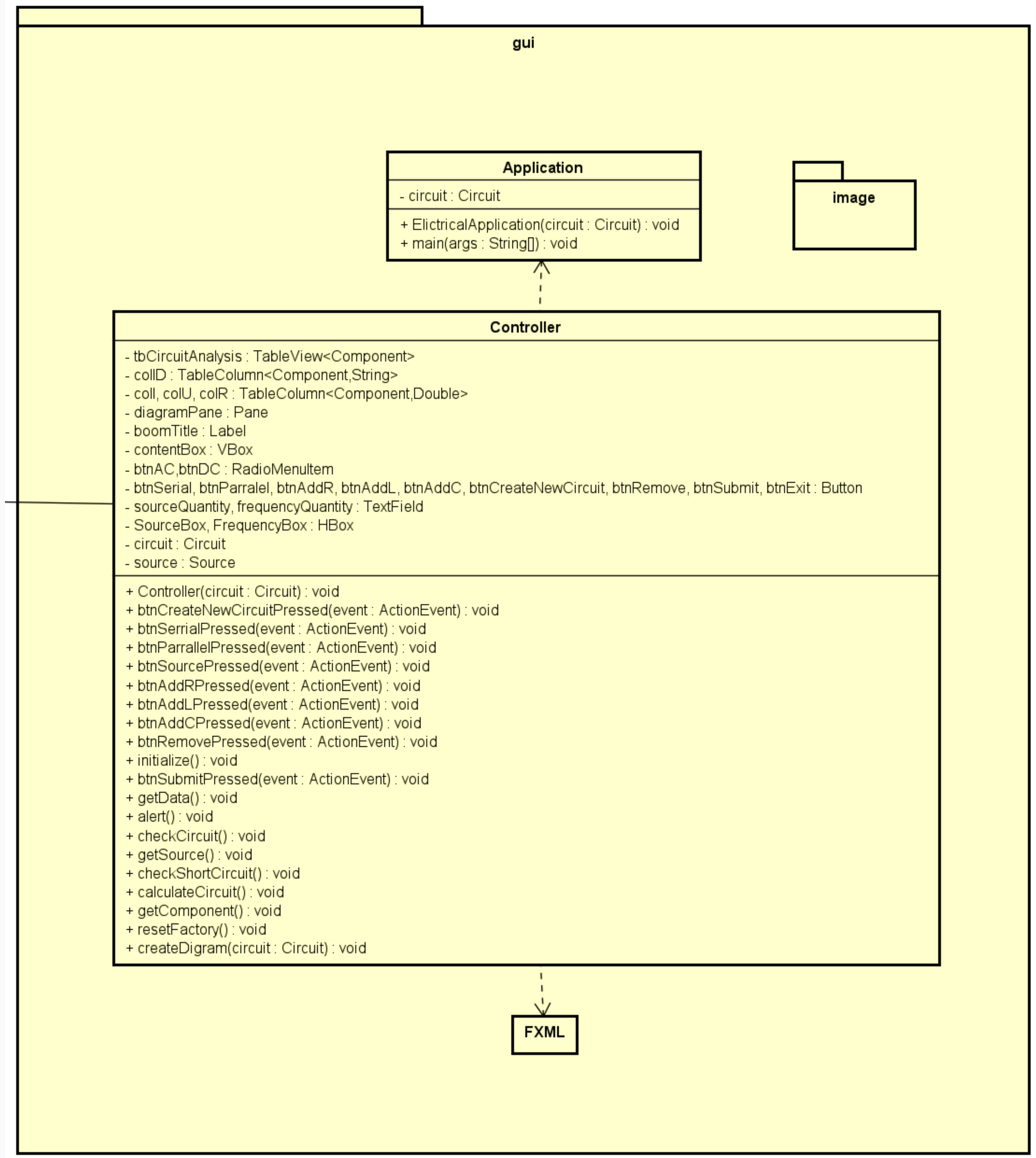
SerialCircuit

+ SerialCircuit() : void
+ calculateZ() : void

Circuit

- source : Source
- MAX_COMPONENTS : int
- nComponents : int
- componentsList : ObservableList<Component>

+ Circuit() : void
+ addComponent(component : Component) : void
+ removeAllComponent() : void
+ removeComponen() : void
+ resetNComponents() : void
+ getSource() : Source
+ addSource(source : Source) : void
+ getNComponents() : int
+ getComponentsList() : ObservableList<Component>
+ displayAnalysis() : void



gui

Application

- circuit : Circuit

+ ElictricalApplication(circuit : Circuit) : void
+ main(args : String[]) : void

image

Controller

- tbCircuitAnalysis : TableView<Component>
- colID : TableColumn<Component,String>
- colI, colU, colR : TableColumn<Component,Double>
- diagramPane : Pane
- boomTitle : Label
- contentBox : VBox
- btnAC,btnDC : RadioMenuItem
- btnSerial, btnParralel, btnAddR, btnAddL, btnAddC, btnCreateNewCircuit, btnRemove, btnSubmit, btnExit : Button
- sourceQuantity, frequencyQuantity : TextField
- SourceBox, FrequencyBox : HBox
- circuit : Circuit
- source : Source

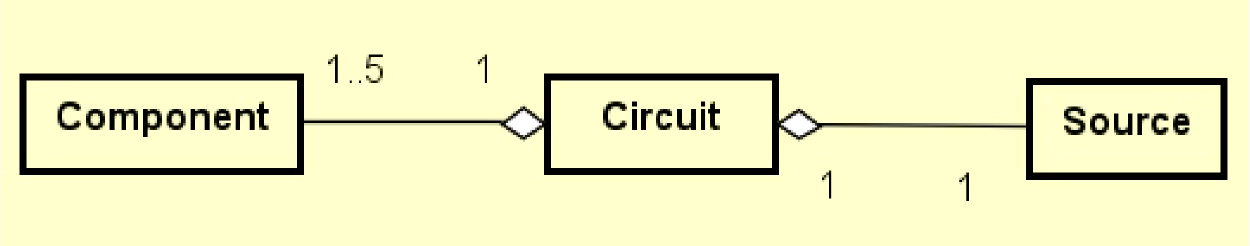
+ Controller(circuit : Circuit) : void
+ btnCreateNewCircuitPressed(event : ActionEvent) : void
+ btnSerrialPressed(event : ActionEvent) : void
+ btnParrallelPressed(event : ActionEvent) : void
+ btnSourcePressed(event : ActionEvent) : void
+ btnAddRPressed(event : ActionEvent) : void
+ btnAddLPressed(event : ActionEvent) : void
+ btnAddCPressed(event : ActionEvent) : void
+ btnRemovePressed(event : ActionEvent) : void
+ initialize() : void
+ btnSubmitPressed(event : ActionEvent) : void
+ getData() : void
+ alert() : void
+ checkCircuit() : void
+ getSource() : void
+ checkShortCircuit() : void
+ calculateCircuit() : void
+ getComponent() : void
+ resetFactory() : void
+ createDigram(circuit : Circuit) : void

FXML

OOP Techniques

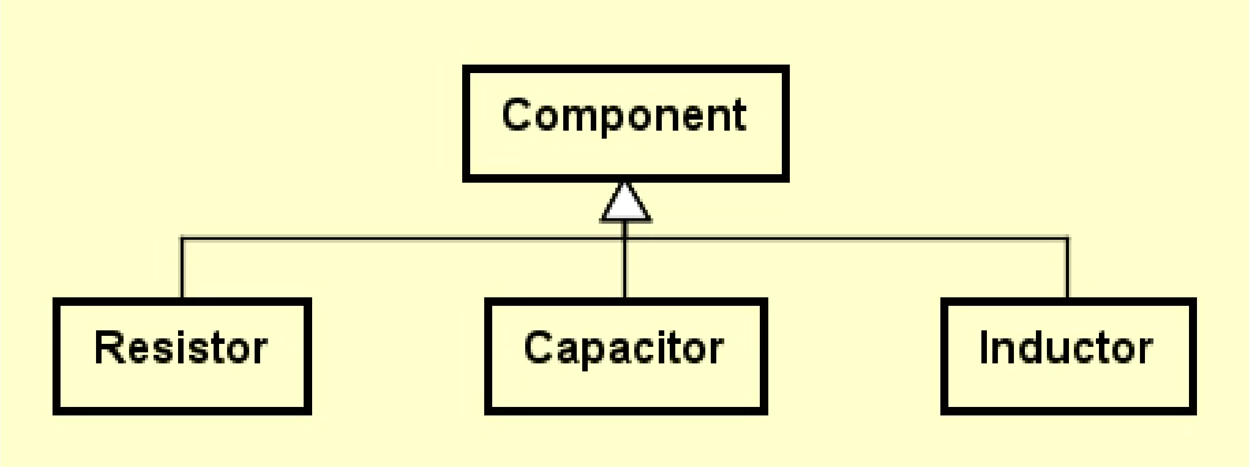
Aggregation

- A source *is a part of* a circuit board
- A component *is a part of* a circuit board

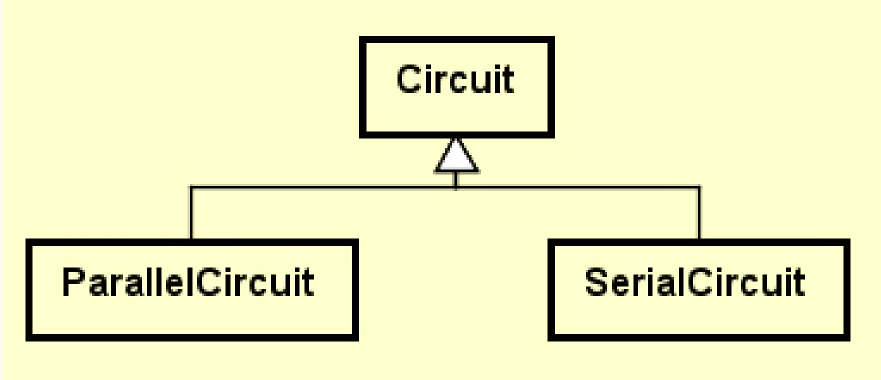


Inheritance

- A resistor *is a* component
- A capacitor *is a* component
- An inductor *is a* component



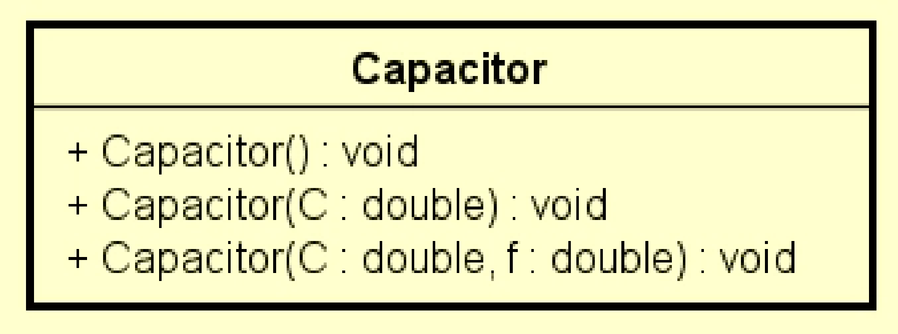
- A parallel circuit *is a* circuit
- A serial circuit *is a* circuit



OOP Techniques

Polymorphism

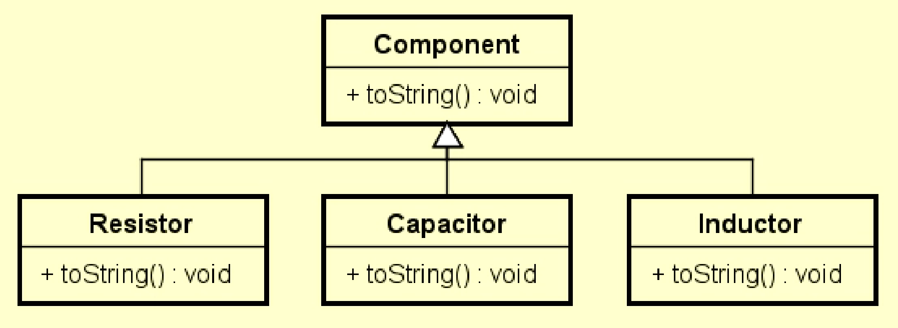
- Static binding

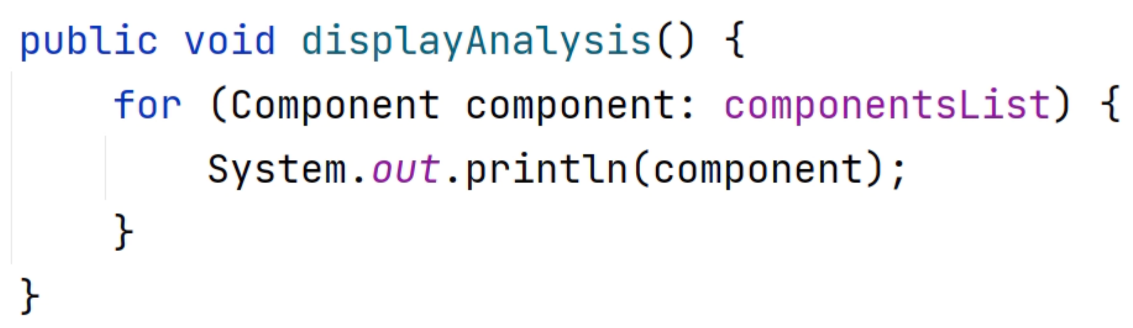


Capacitor

+ Capacitor() : void
+ Capacitor(C : double) : void
+ Capacitor(C : double, f : double) : void

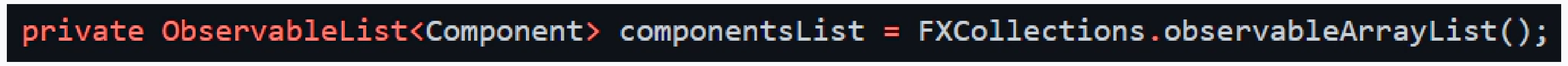
- Dynamic binding



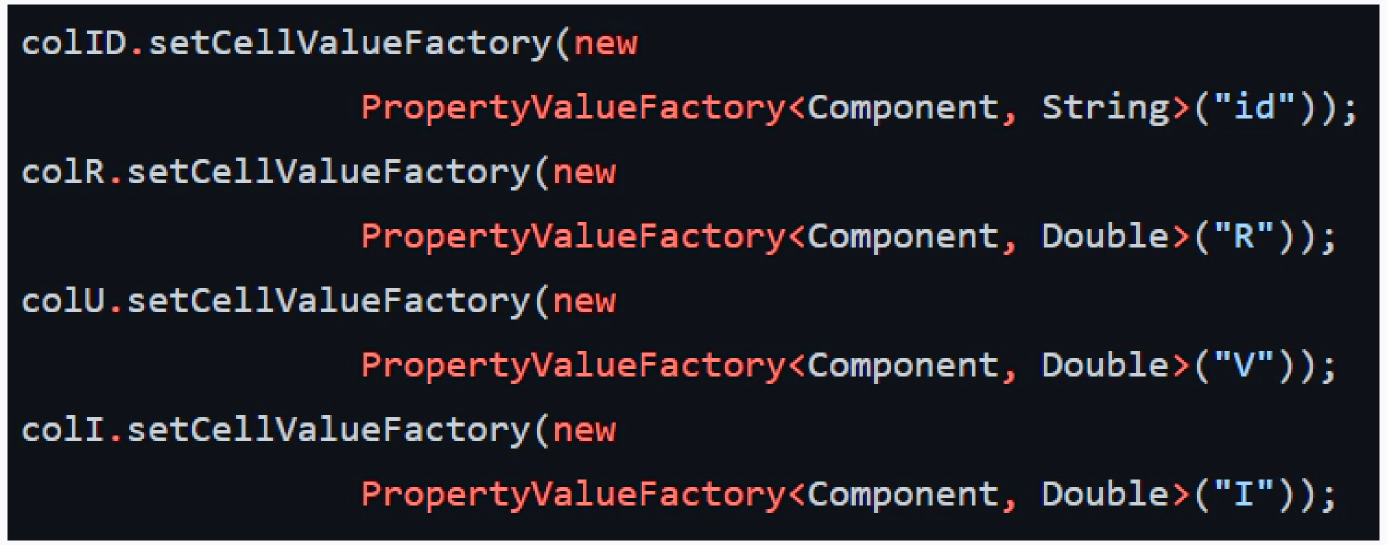


```java
public void displayAnalysis() {
    for (Component component: componentsList) {
        System.out.println(component);
    }
}
```

Generics



```java
private ObservableList<Component> componentsList = FXCollections.observableArrayList();
```



```java
colID.setCellValueFactory(new
                PropertyValueFactory<Component, String>("id"));
colR.setCellValueFactory(new
                PropertyValueFactory<Component, Double>("R"));
colU.setCellValueFactory(new
                PropertyValueFactory<Component, Double>("V"));
colI.setCellValueFactory(new
                PropertyValueFactory<Component, Double>("I"));
```

Demo video

bitly.com/khong-so-chay-demo-video