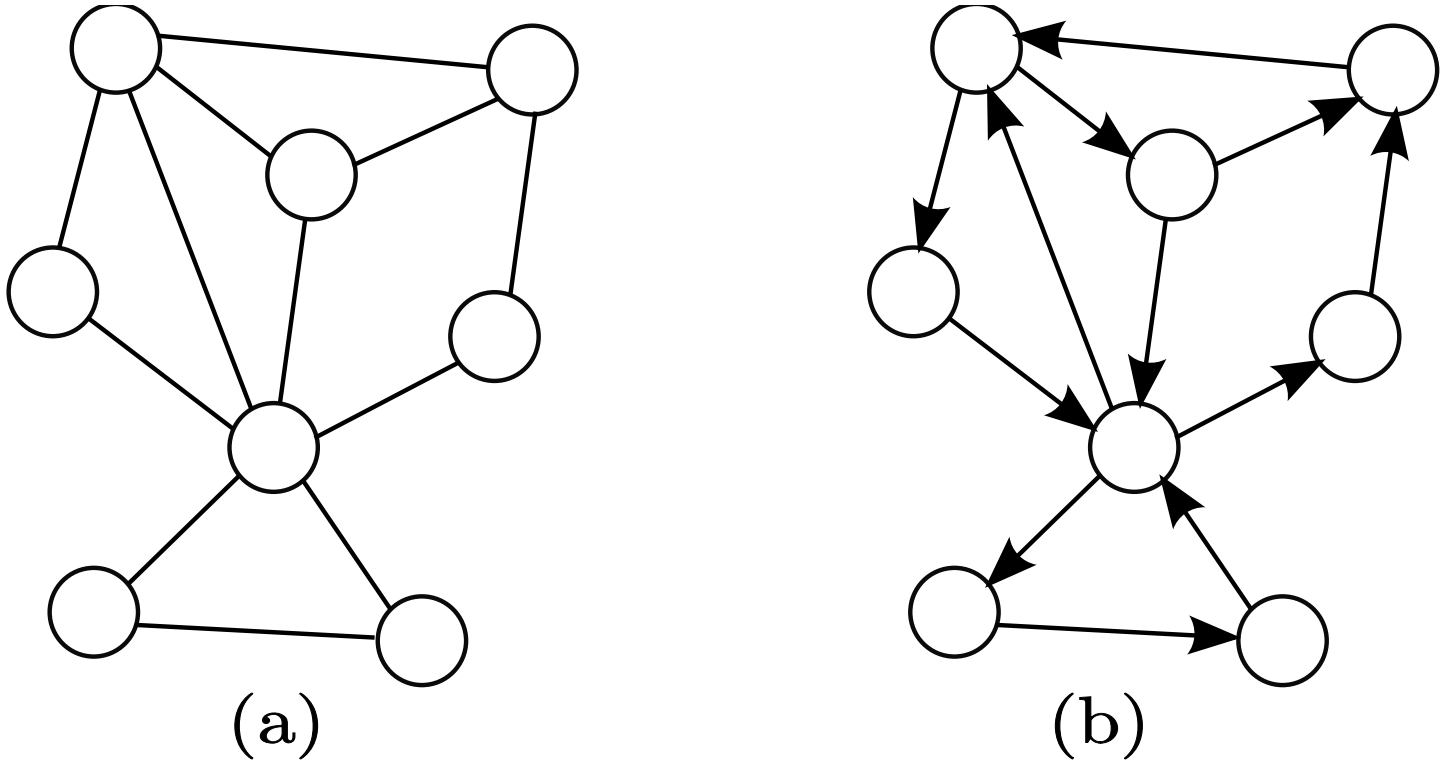
Undirected vs. Directed Graph

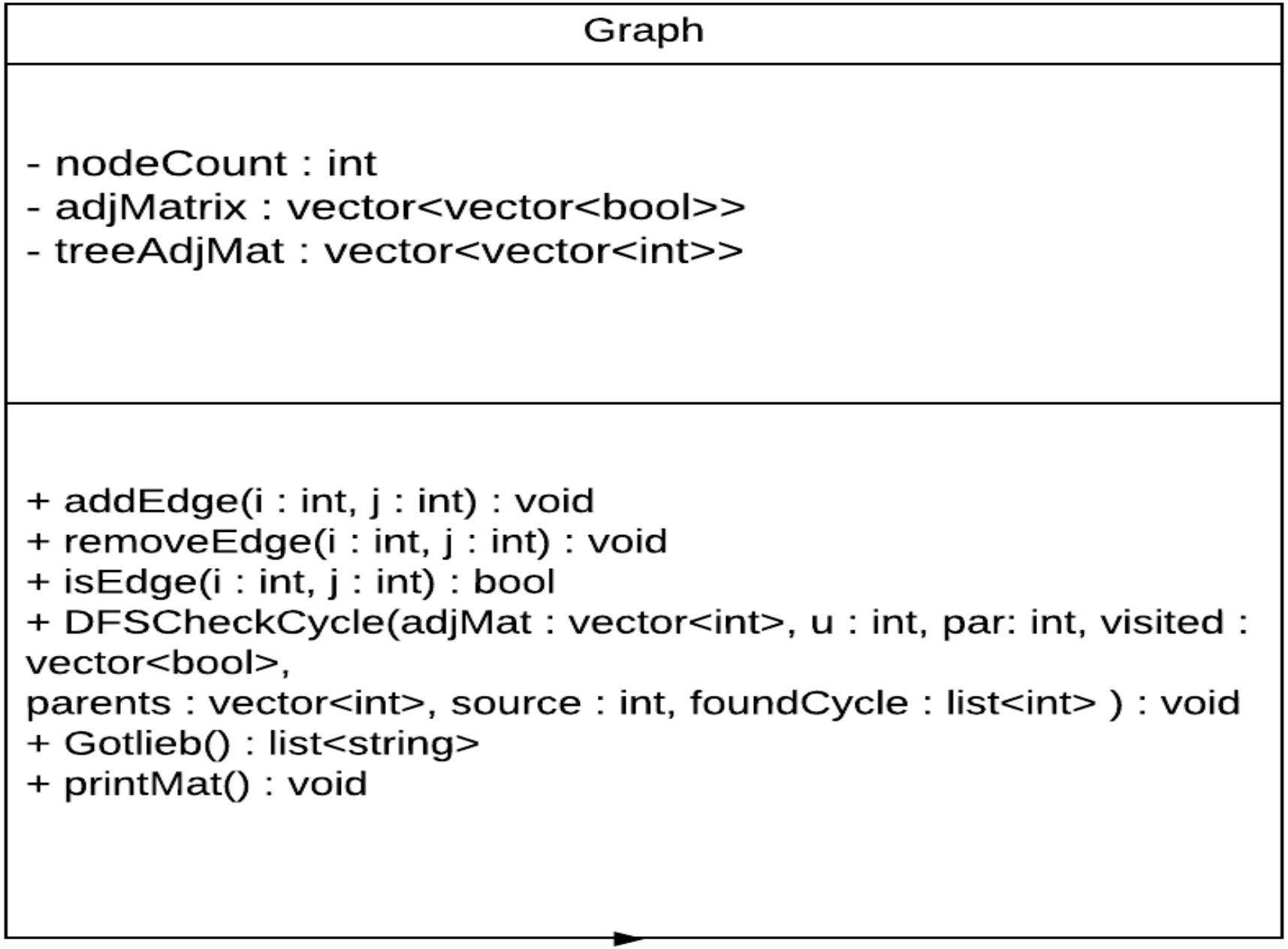


G(V, E)

C++ Implementation (with boost::graph): https://godbolt.org/z/Kf6rcx

Nuts and Bolts in Graphs

- Adjacency matrix
  - C++ Implementation : https://godbolt.org/z/55vs3K
- Incidence matrix
  - C++ Implementation : https://godbolt.org/z/K99YdM


Graph
- nodeCount : int
- adjMatrix : vector<vector<bool>>
- treeAdjMat : vector<vector<int>>
+ addEdge(i : int, j : int) : void
+ removeEdge(i : int, j : int) : void
+ isEdge(i : int, j : int) : bool
+ DFSCheckCycle(adjMat : vector<int>, u : int, par: int, visited :
vector<bool>,
parents : vector<int>, source : int, foundCycle : list<int>) : void
+ Gotlieb() : list<string>
+ printMat() : void

Mesh

- res : vector<float>
- volt : vector<float>
- current : vector<float>
- circuit : vector<vector<bool>>
- mcurrent : vector<vector<int>>
- a : vector<vector<float>>
- m : int // the number of sides eliminated to have a final tree graph
- c : int
- indx: vector<int>

+ setdircur(int r, int c, vector<vector<int>> mcurrent) : void
+ createmat(int m, int r, vector<vector<int>> mcurrent, vector<vector<float>> res, int c) : void
+ createb (vector<double> b, int r, int c, int m, vector<vector<float>> volt, vector<vector<int>> mcurrent) : void
+ solnrefine (vector<vector<float> a, vector<vector<float> alud, int n, vector<int> indx, vector<float> b, vector<float> x) : void
+ sovr (int c, int r, vector<vector<int>> mcurrent, vector<double> x, int m) : float
+ tension (int r, vector<vector<float>> res, vector<vector<float>> current, vector<vector<float>> volt) : void
+ ludcmp() : void

Cycle Detection

- construction of spanning tree (via Gotlieb's algorithm, completed)
- construction of independent loops (completed)

Network simulation

- set loop directions (mesh method for solving circuit)
  - See also slide 18 of circuit.pdf
- set equation system
  - Methods: LU or QR decomposition (Linear case); Newton (Nonlinear case)
  - Example 1(Newton+LU) : https://godbolt.org/z/3nr4Pr
  - Example 2(Newton) : https://godbolt.org/z/enaz6c
  - Example 3(QR/Gaussian) : https://godbolt.org/z/qv5eMq
- Find branch current and voltage

To-do

- Unit testing (TDD, Catch2, gtest)
- Move to Boost Graph Library and Eigen for production codes
- Integrate existing codes with INSEl engine
- Think about real world data retrieval
  - https://github.com/Framstag/libosmscout/
  - https://github.com/gboeing/osmnx