Paris Session 2022

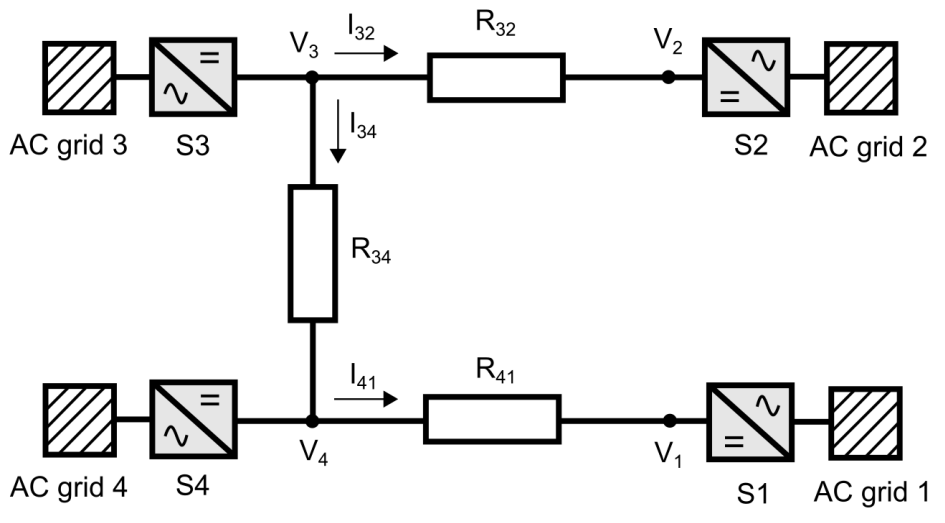
Converters to control current distribution in dc grids

B4 PS1 Question 1.10

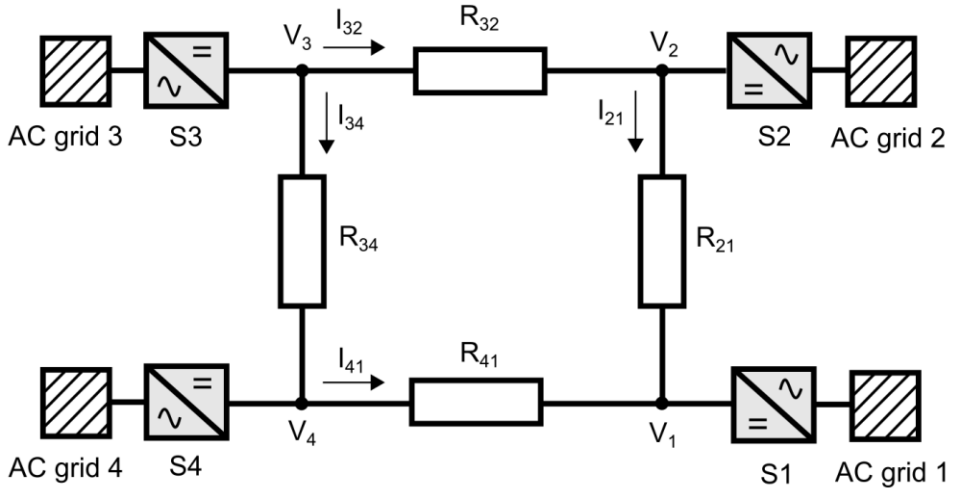
Power flow control in large DC networks will require new technologies to control the power flow. What control options are available for DC grid power flow? What is the best control method to manage power flow in DC Grids from operational and planning perspectives?

Florent MOREL, France

Problem statement

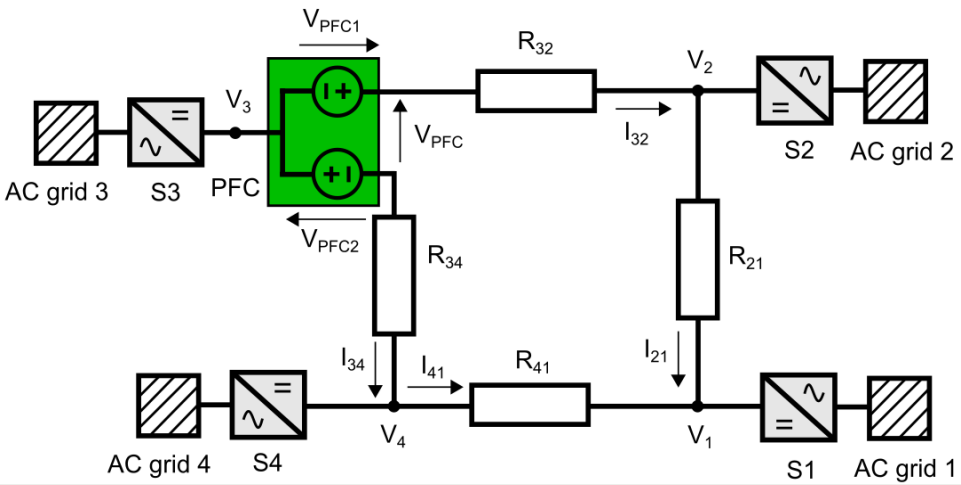


- Radial dc multi-terminal systems
  - Power converters can control current in each conductor



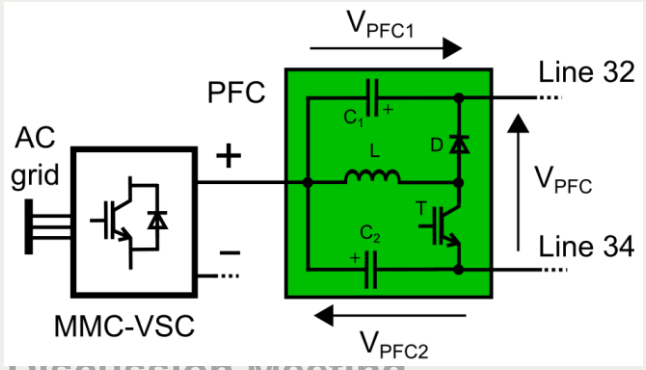
- Meshed dc systems
  - Not enough degrees of freedom to control all currents
  - Potential congestions
  - Potential power curtailments
  - Control of current distribution in dc grids needs additional hardware

Interline power flow controllers



- Power electronic converter
- Inserts voltages in series with two conductors
- Adds a degree of freedom
- Inserted voltages ~ some kV
- Insulation to ground = pole-to-ground voltage

$$V_{PFC1} I_{32} = V_{PFC2} I_{34}$$



- Several topologies investigated in the literature
- Ratings of power devices in the range of existing applications

Challenges and perspectives

- Technology
  - Insulation
  - Protection
  - Power supply
- Control
  - Interoperability issues
  - Control to be validated
- Planning
  - Need to consider these devices in grid studies
  - Need for models for cost benefit analysis