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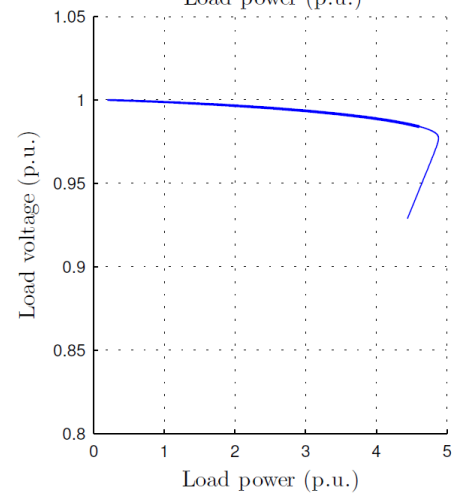
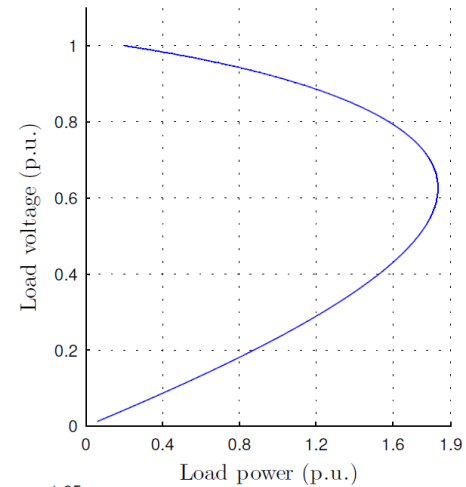
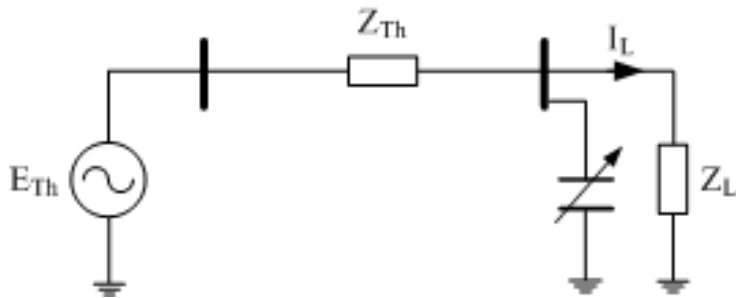
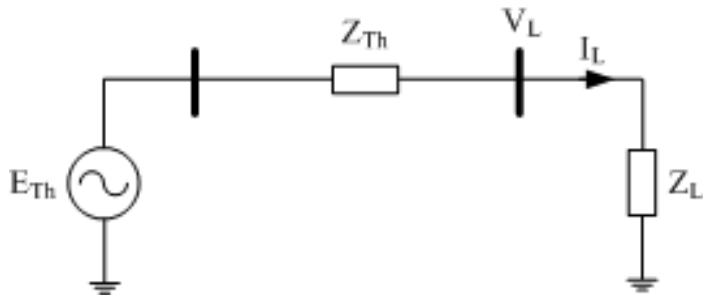
# Phasor measurement unit and online voltage stability monitoring

Thuc Dinh Duong

**STRON<sup>2</sup>grid**  
Smart Transmission Grids Operation and Control  
KTH - NTNU - AALTO - DTU - UI

Smartgridkonferansen - Trondheim, Sept. 10, 2013

## Voltage stability issue



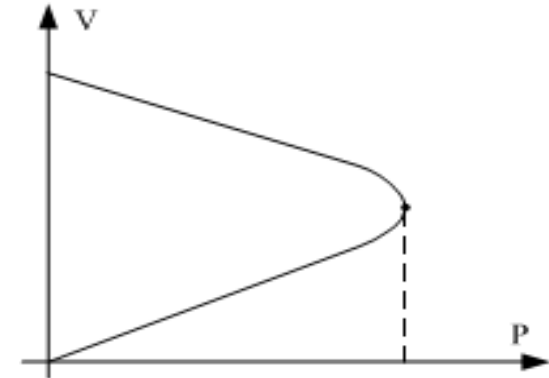
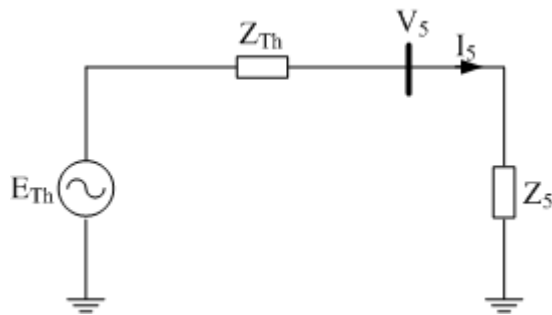
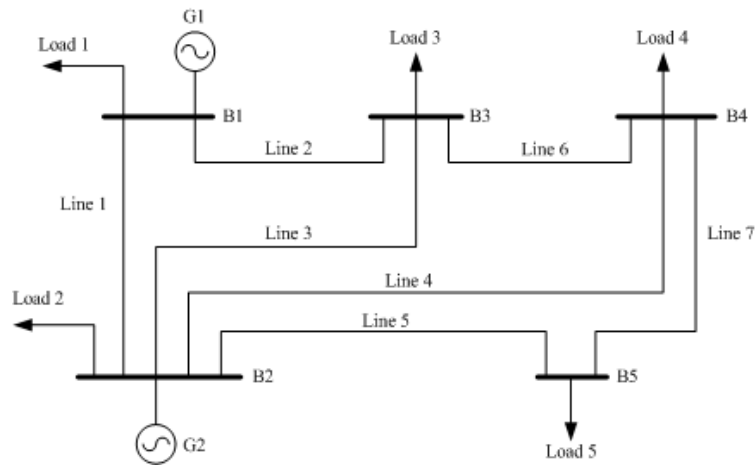
(a) PV-curve

Source:  
Vegar's master thesis



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# Thevenin equivalence: a solution for online voltage stability monitoring?

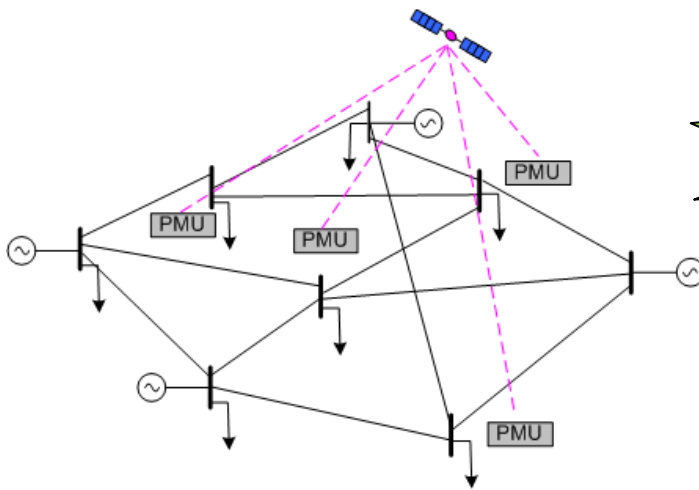
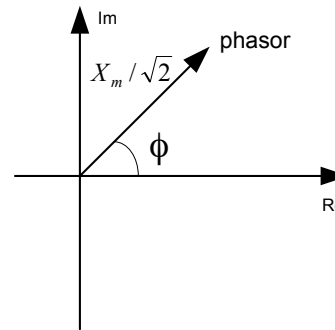
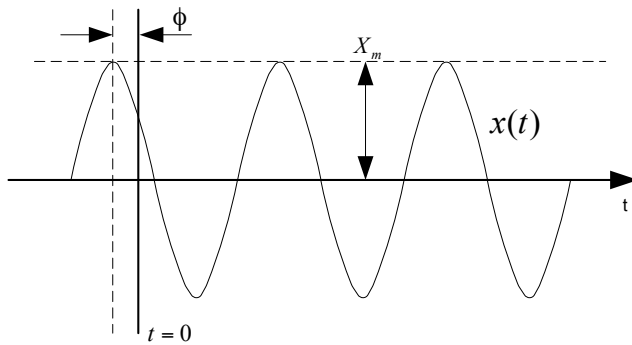


$$|Z_5| = |Z_{Th}|$$

**Maximum loadability**



# Phasor measurement unit (PMU)



phasors

Frequency,  
its derivative

Synchronous  
timestamp

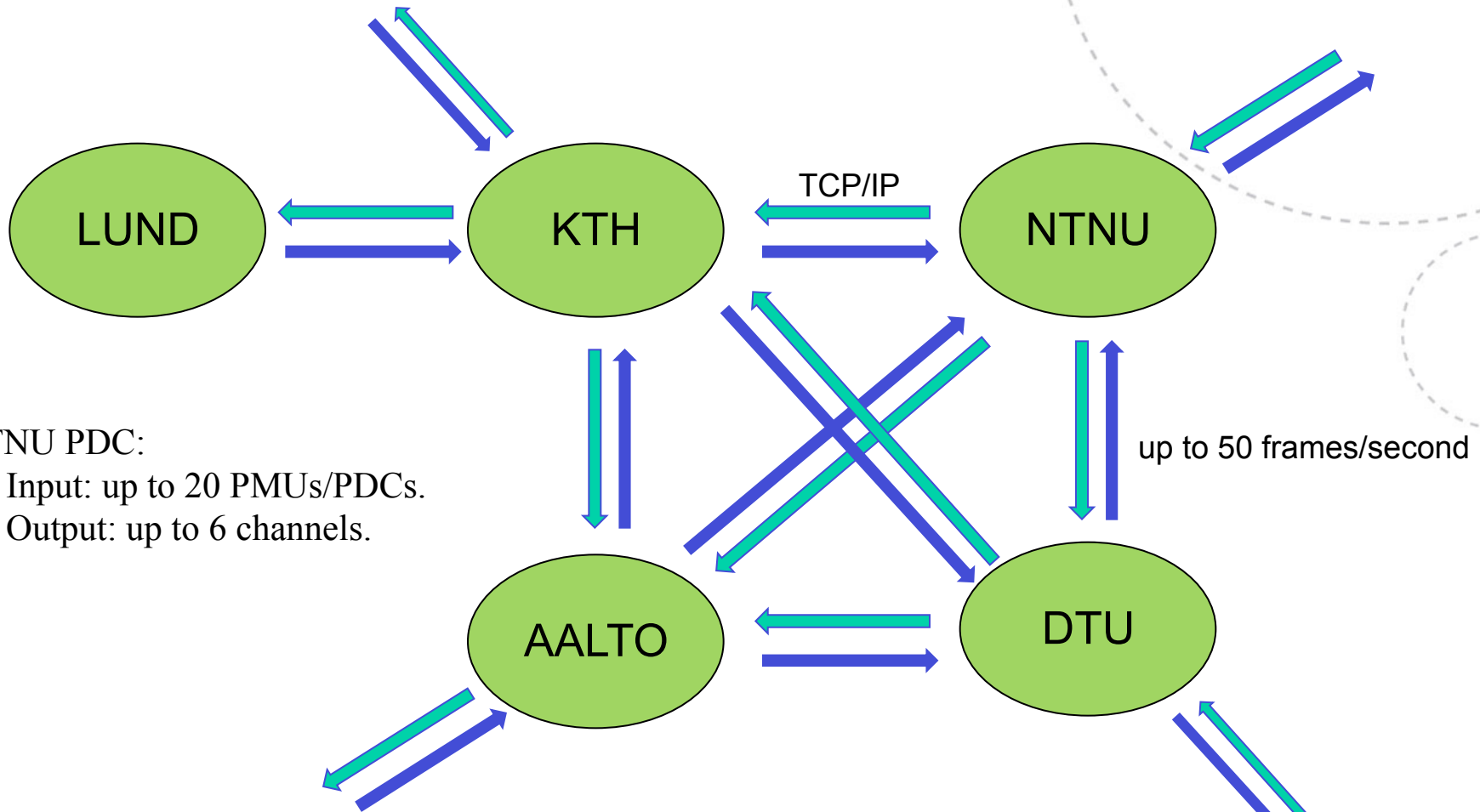
communication

High measurement  
resolution



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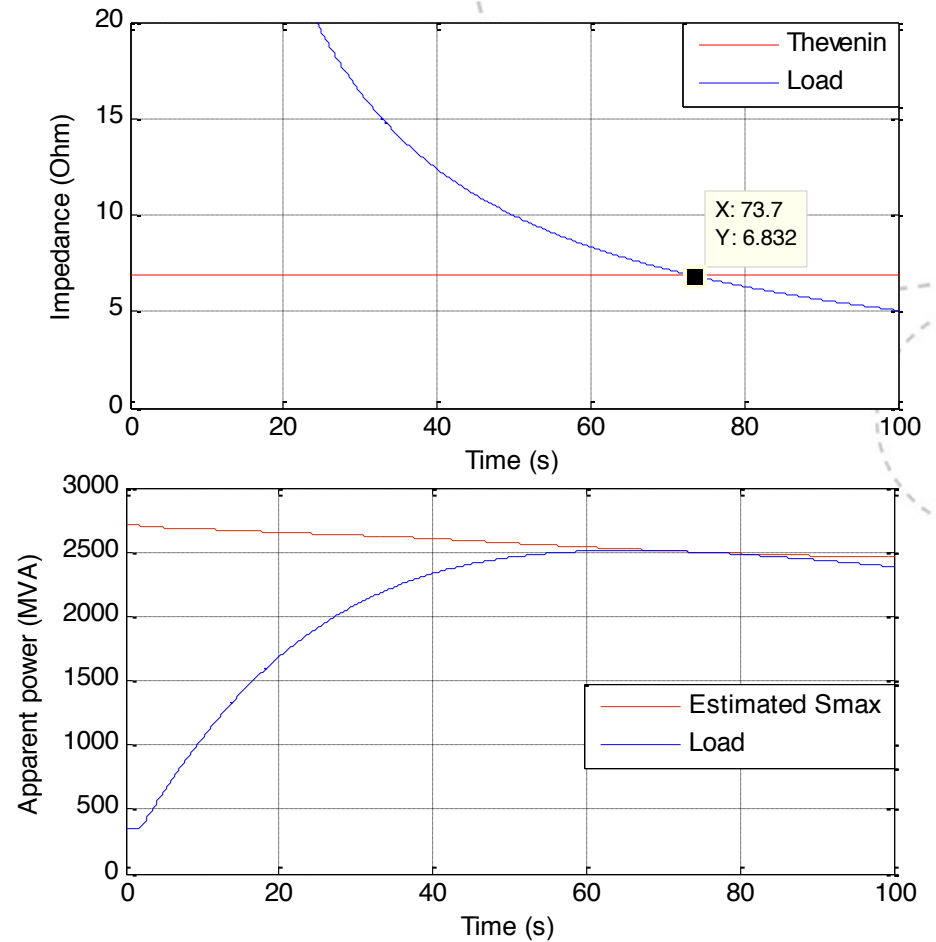
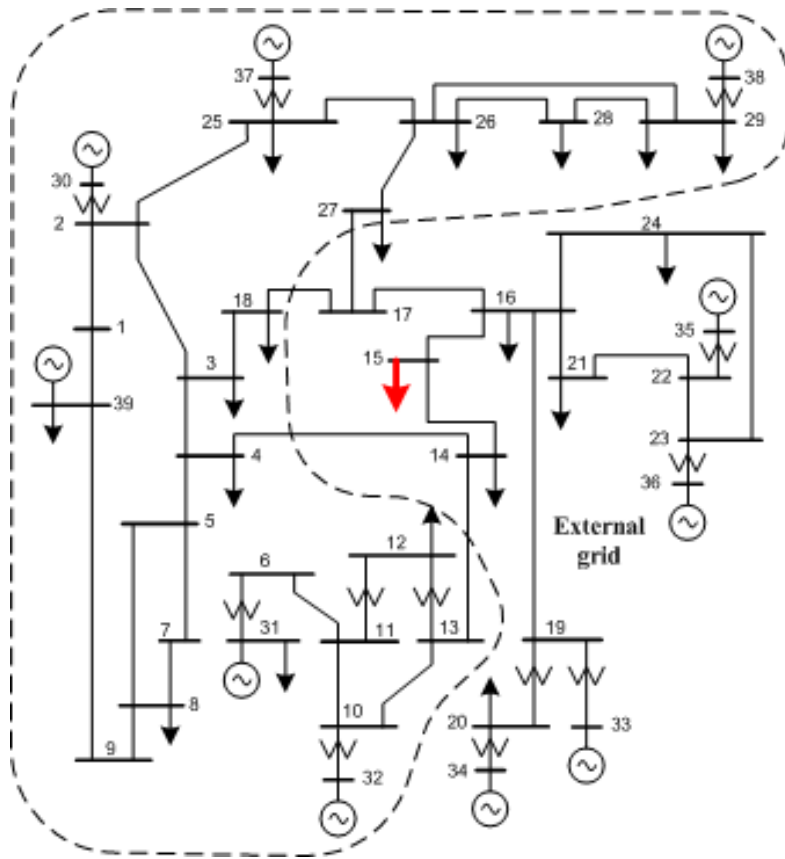
## Phasor communication structure among universities in STRONgrid project



NTNU PDC:

- Input: up to 20 PMUs/PDCs.
- Output: up to 6 channels.

## First outcomes: simulation on the 39-bus system



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# Takk for oppmerksomheten