Global Footprint

- Headquarter
- Sales
- Manufacturing
- Services

Changzhou I CN
DC Product

Changzhou II CN
AC Product

Changzhou III CN
DC Product

Yancheng CN
Energy Product

HaiPhong Vietnam
AC/DC/Energy Product

Columbus Ohio
AC/DC/Energy Product

US Manufacturing

- First US Manufacturing site: **Columbus Ohio**
- 137,000 sqft
- Production starting at the end of Q2, 2024
- Shipments ready by Q3, 2024
- 150kW & 320kW Titan All-in-One
- Modular Battery Pack with 314 Ah cells
- Metis String Inverter 215 kW

Wind Power Storage Project with 476MWh

Star Charge®

Area	Product	Number	Total
Southern	3.44MW/3.44MWh	55	200MW/200MWh
	2.75MW/2.75MWh	4	
Area	**Product**	**Number**	**Total**
Northern	3.44MW/3.44MWh	78	276MW/276MWh
	2.75MW/2.75MWh	3	
Area	**Product**	**Number**	
Total	PCS Integrated Boost Cabin	140	

The overall capacity of the DC battery-side energy storage system reaches 476MW/476MWh.
It is currently the largest 1P electrochemical energy storage project in China.

Remote Energy Storage: 600MW/1200MWh

Project Background:

Xiangjia standalone energy storage project is located on the border between Gonghe County and Xinghai County in Hainan, Qinghai Province, approximately 800 meters north from State Grid Xiangjia 750kV Substation, covering an area of 150 acres.

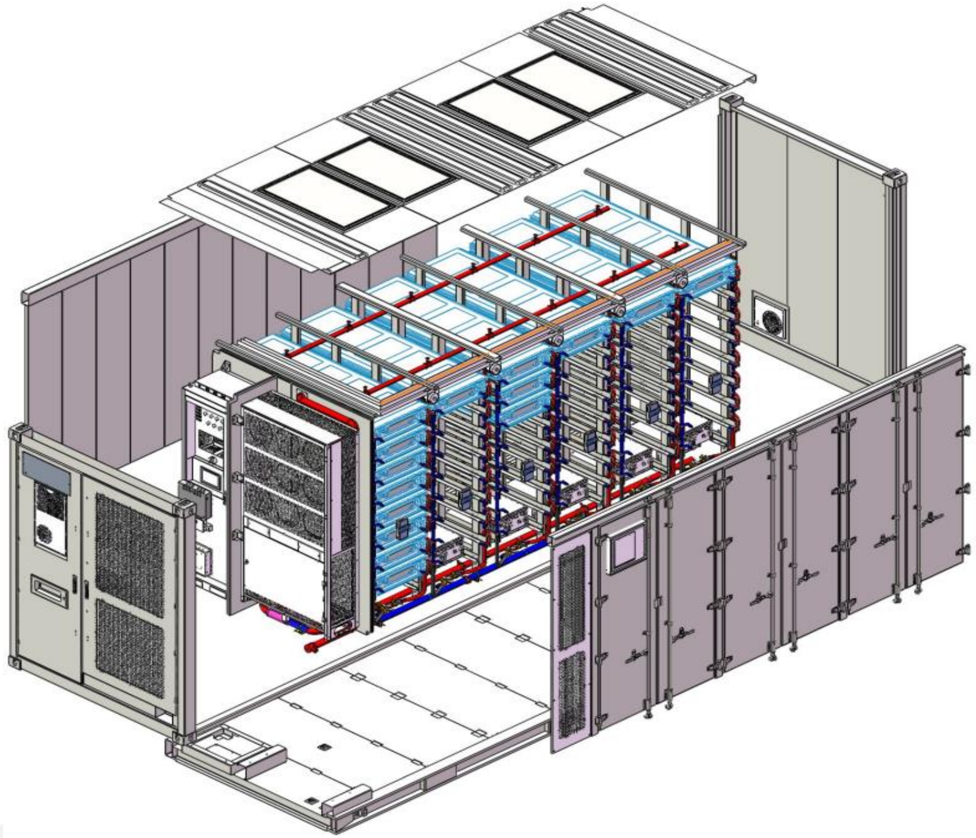
Project Details:

Type: Standalong Battery ESS

Capacity: 600MW/1200MWh, to be constructed in three phases

It is a successful application in high altitude, cold, and high-sand enviroment.

BESS Modular Container



Project	Parameters
Rated energy	5015.96kWh
recommend operating voltage range	1040-1497.6Vdc
Nominal voltage	1331.2Vdc
Maximum continuous charge-discharge rate	0.5P
Operating temperature range	-30~55 ℃
Humidity	0-95% RH
Protection level	IP55
Fire protection system	Aerosol + water spray
Elevation	<3000m
Weight	≈ 43t
Communication mode	CAN/RS485/Ethernet

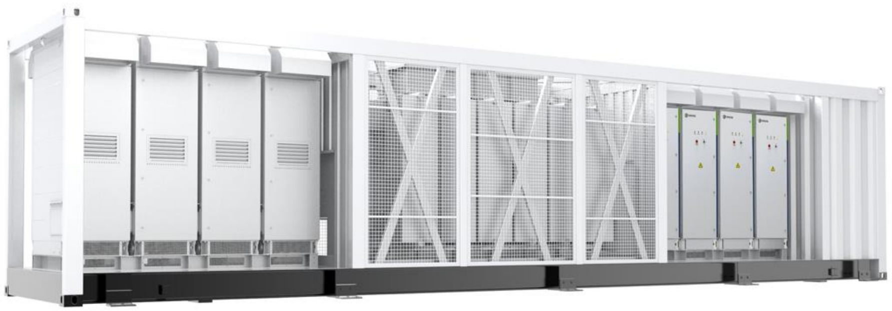
High energy density: Using 314Ah energy storage cell, higher volume energy density, Economical land area

Ultra-high security: Cell real-time status monitoring + cell-level thermal barrier

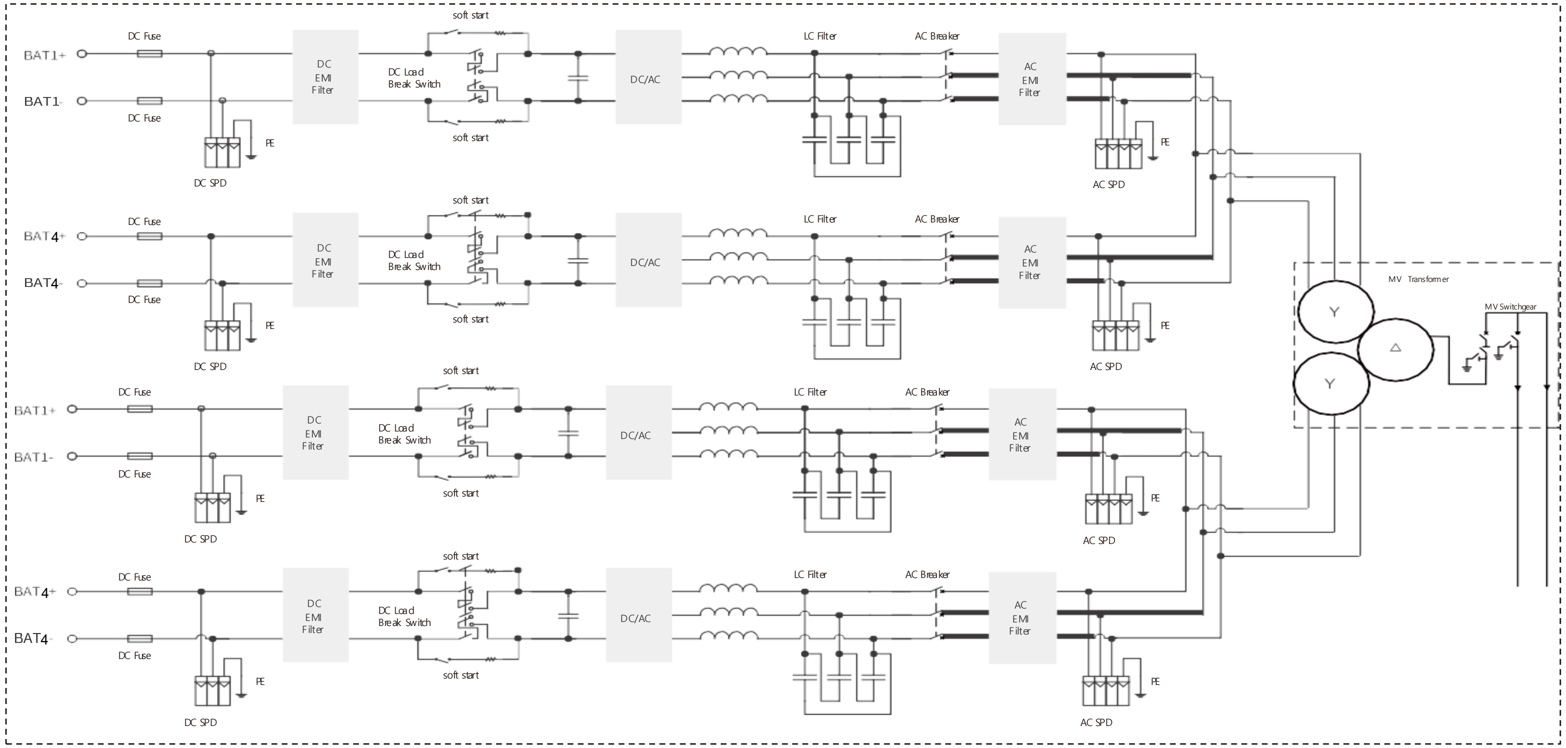
intelligent liquid cooling temperature control: Modular adjustable pipeline to achieve high temperature performance, long system life, low auxiliary power consumption

Batteries Pack and String Inverter easy Installation

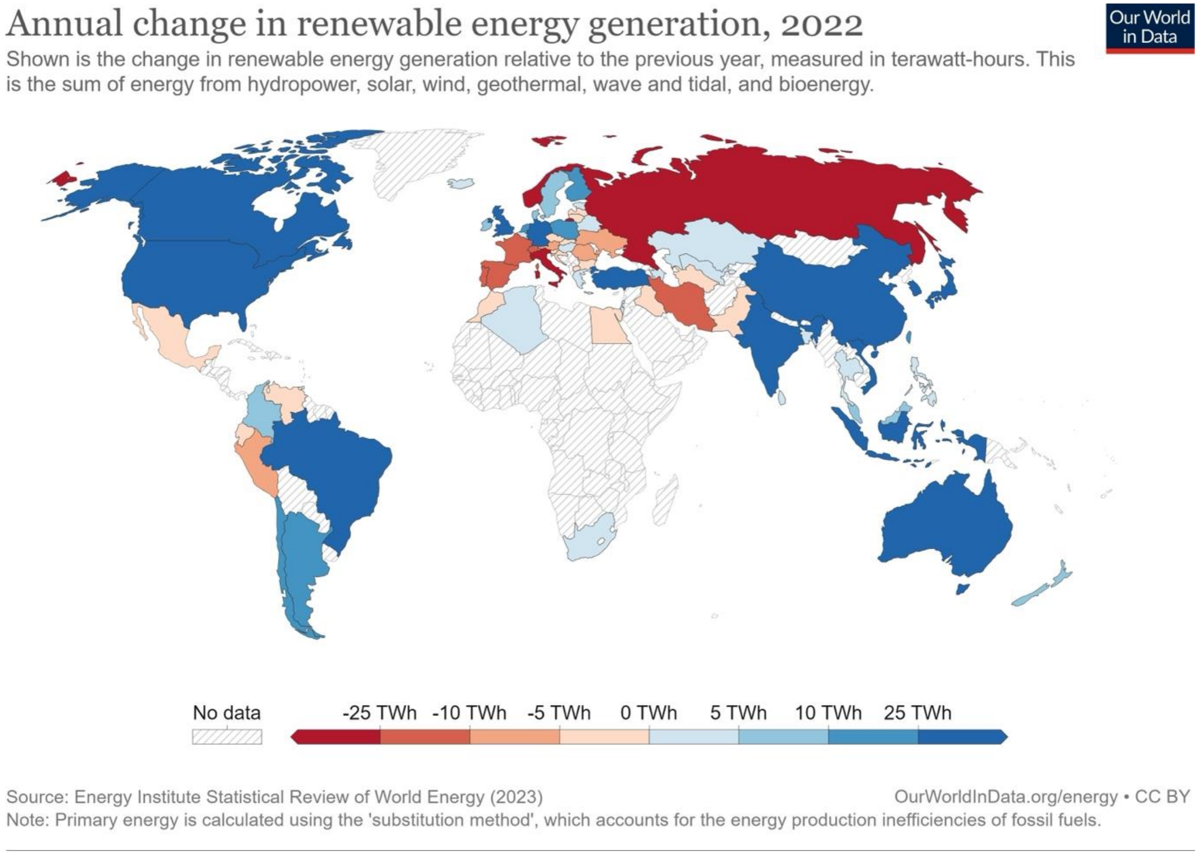
BESS Modular Inverter with Transformer

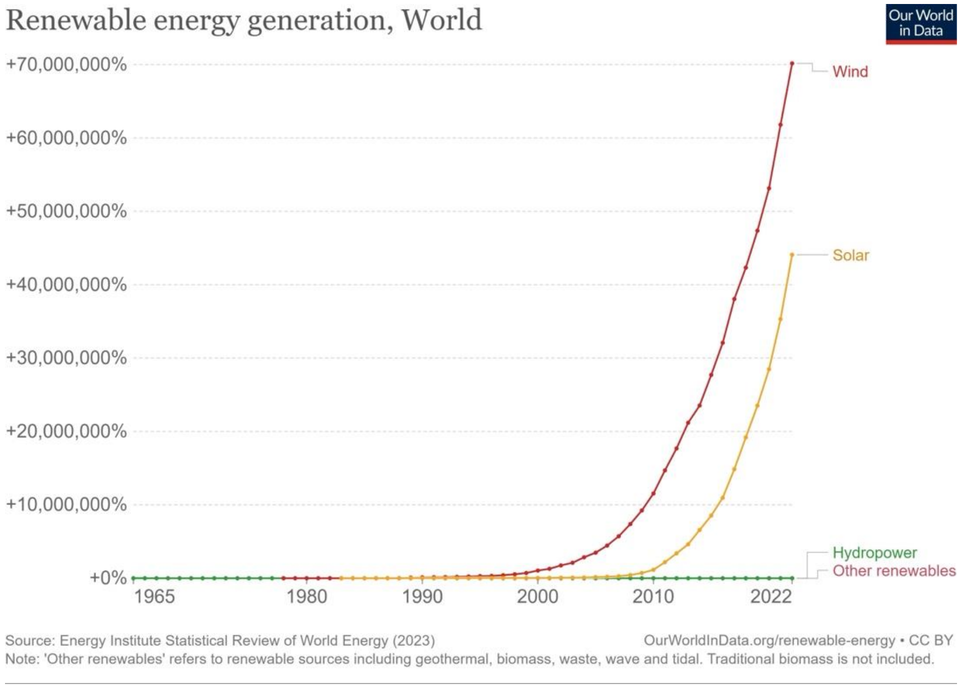


Circuit Diagram



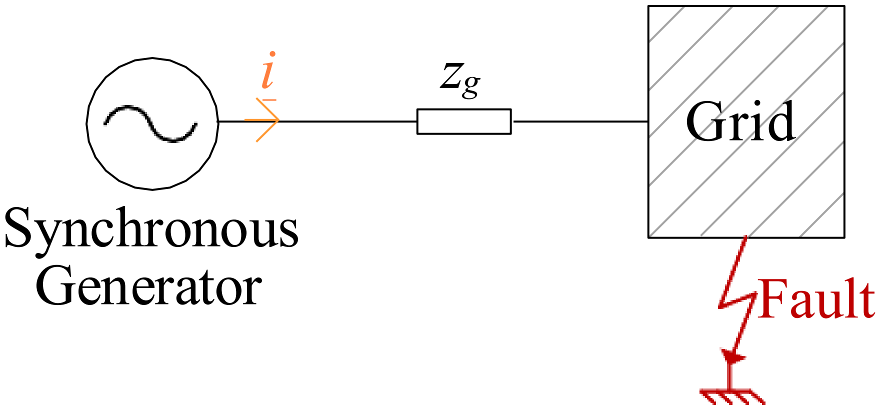
Renewable Energy Generation

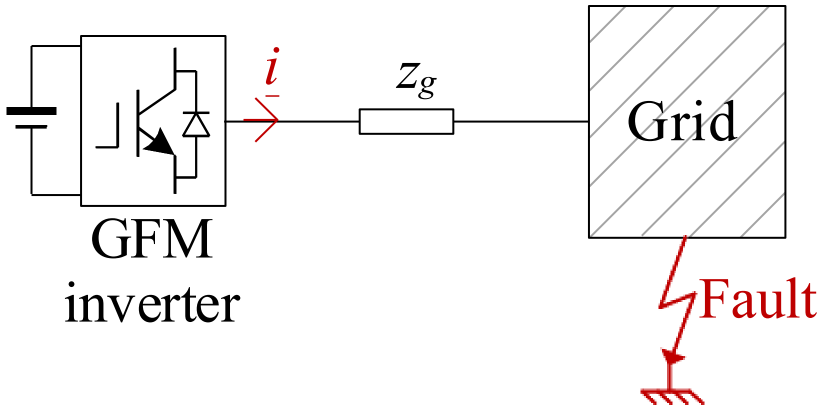




➢ **"Grid-forming"** control considered to be the enabler for the transition,

Problem Overview



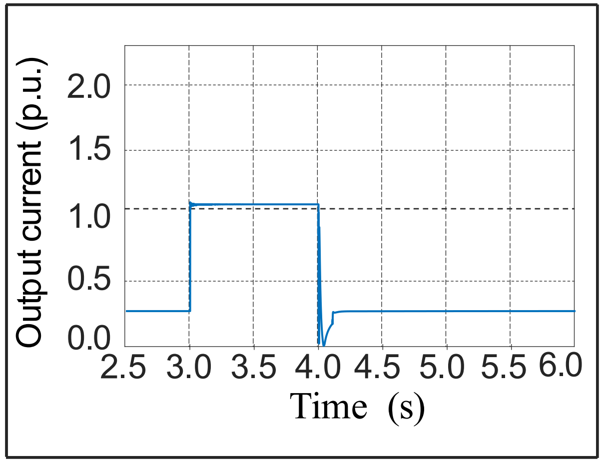


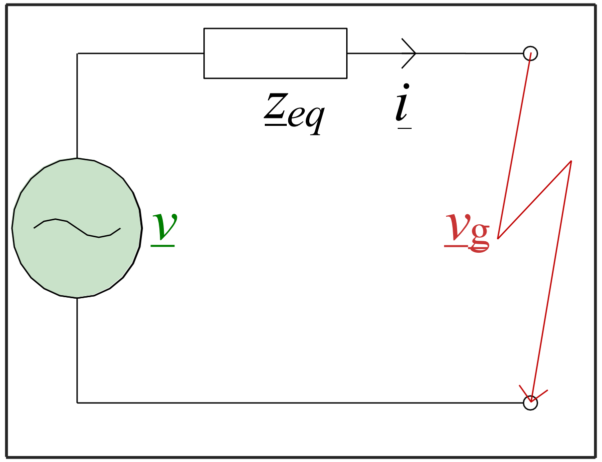
- The total fault current **can** be supplied by the generator.
- Fault current limitation strategies **are not** required.

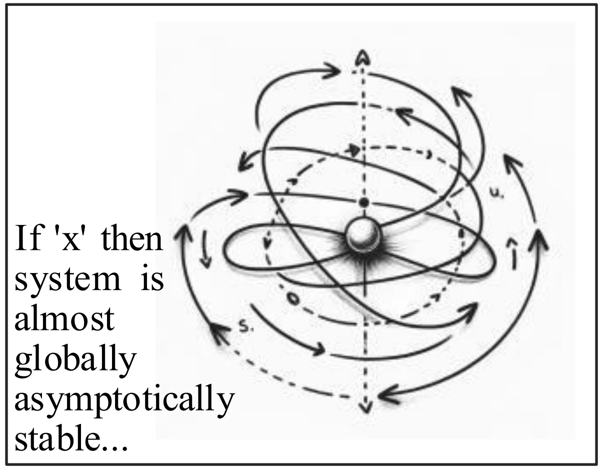
- The total fault current **cannot** be supplied by the inverter.
- Fault current limitation strategies **are** required.

Courtesy Professor Dr Florian Doerfler University of Zurich

Problem Overview







Current Limitation and Overcurrent Utilization

Limit the current **promptly** to protect the inverter while fully utilizing its **over-current capability**.

Preserve Grid-Forming Capability

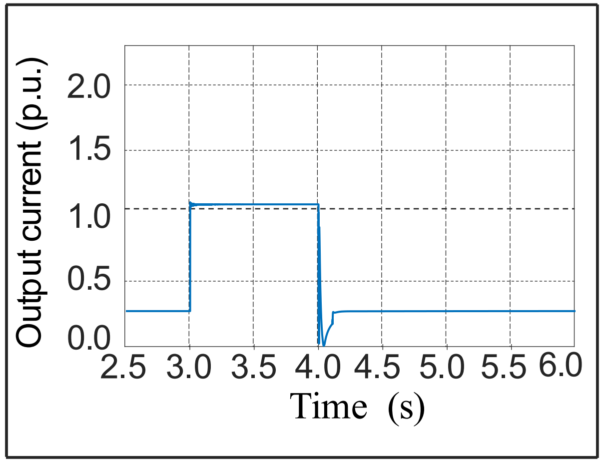
Preserve **grid-forming capabilities** during a fault **despite current limitation**.

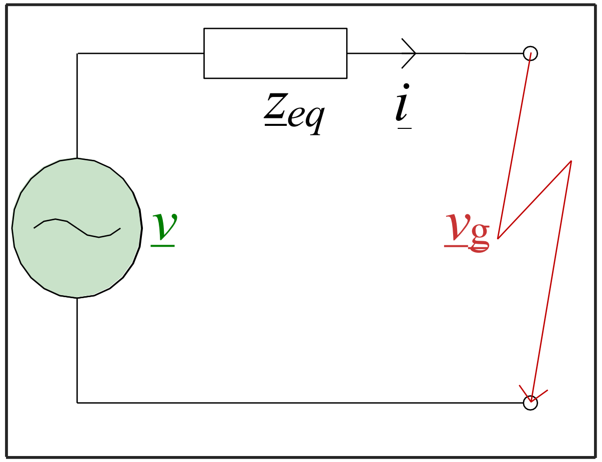
Transient Stability Guarantees

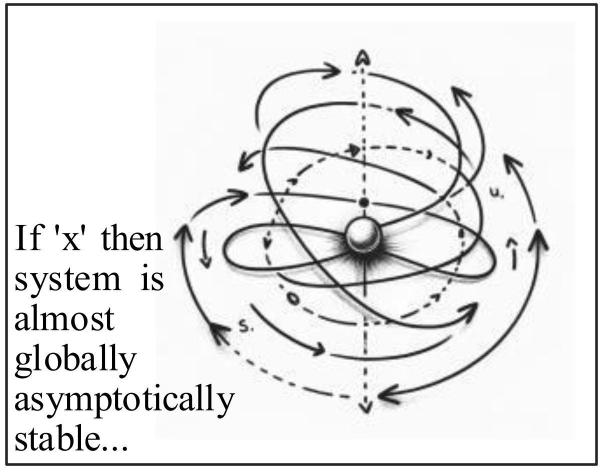
Guarantees for **transient stability** must be obtained for converter-interfaced power systems considering **current limitation**.

Courtesy Professor Dr Florian Doerfler University of Zurich

Problem Overview







Current Limitation and Overcurrent Utilization

Limit the current **promptly** to protect the converter while fully utilizing its **over-current capability**.

Preserve Grid-Forming Capability

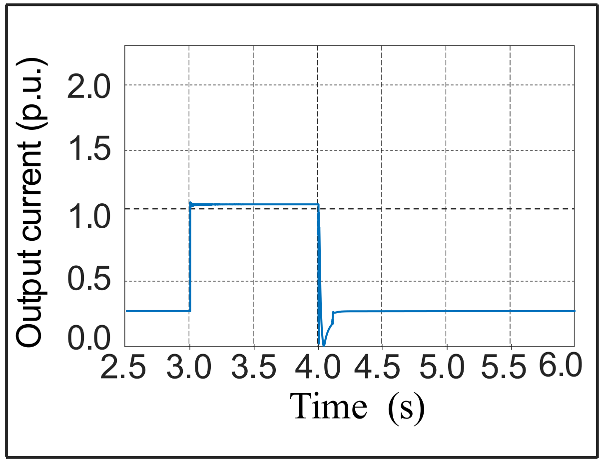
Preserve **grid-forming capabilities** during a fault **despite current limitation**.

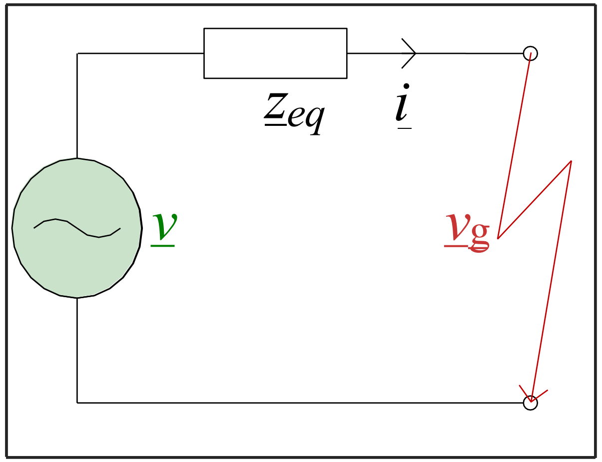
Transient Stability Guarantees

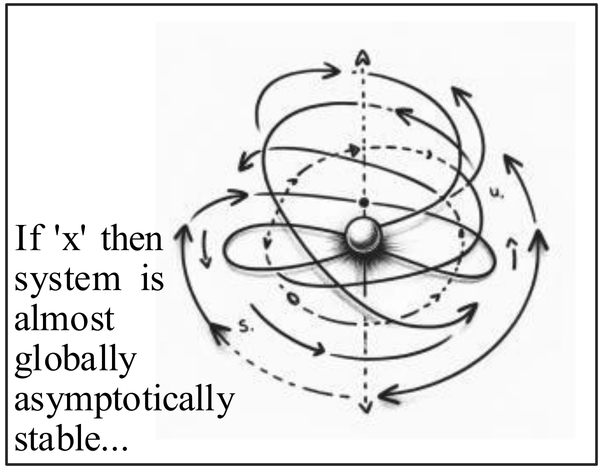
Guarantees for **transient stability** must be obtained for converter-interfaced power systems considering **current limitation**.

Courtesy Professor Dr Florian Doerfler University of Zurich

Problem Overview







Current Limitation and Overcurrent Utilization

Limit the current **promptly** to protect the converter while fully utilizing its **over-current capability**.

Preserve Grid-Forming Capability

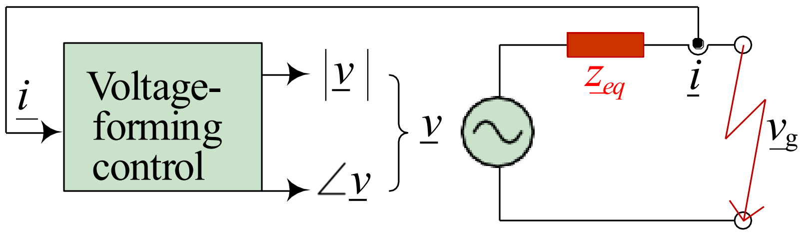
Preserve **grid-forming capabilities** during a fault **despite current limitation**.

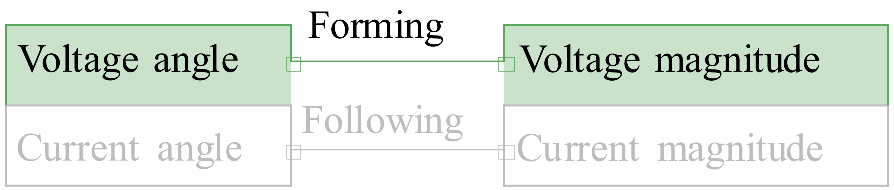
Transient Stability Guarantees

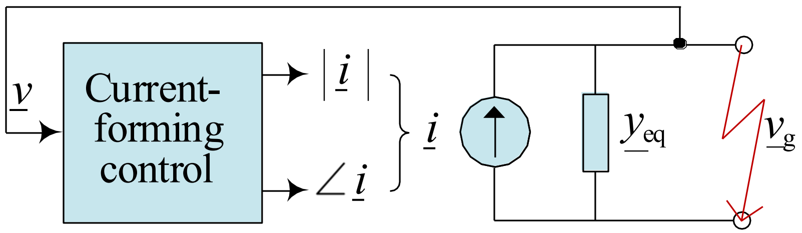
Guarantees for **transient stability** must be obtained for converter-interfaced power systems considering **current limitation**.

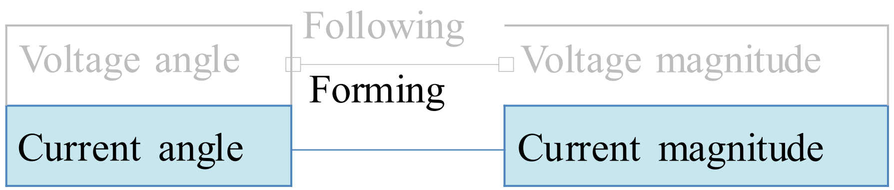
Courtesy Professor Dr Florian Doerfler University of Zurich

Forming Controls and Current Limitation

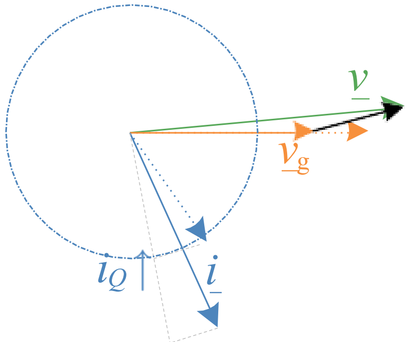






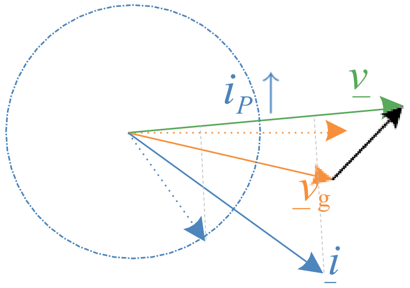


Grid Voltage Dip



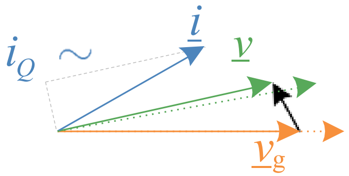
overcurrent

Grid Phase Jump



overcurrent

Grid Voltage Dip

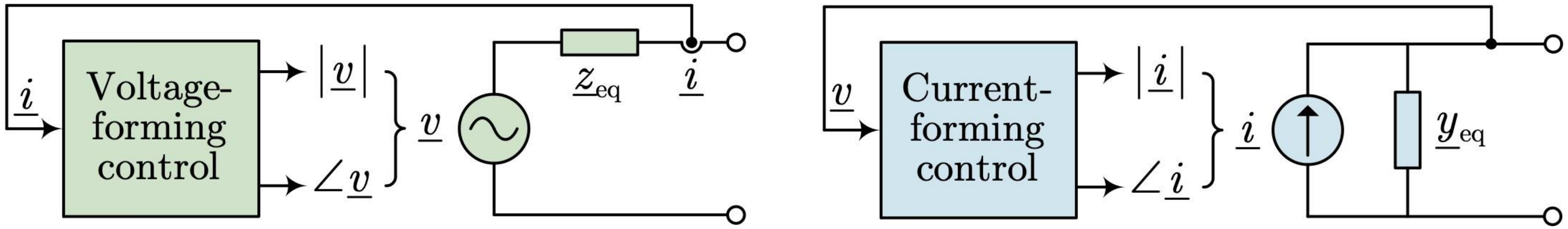


No services provided

Courtesy Professor Dr Florian Doerfler University of Zurich

Forming Controls and Current Limitation - explanation

Star Charge



facts during current saturation (independent of control architecture):
1 the current magnitude is imposed, 2 the voltage magnitude follows the circuit law ("voltage decline"), & 3 the voltage angle can still be imposed

- ! current magnitude $|i|$ is thus "formed" & voltage-forming is impossible

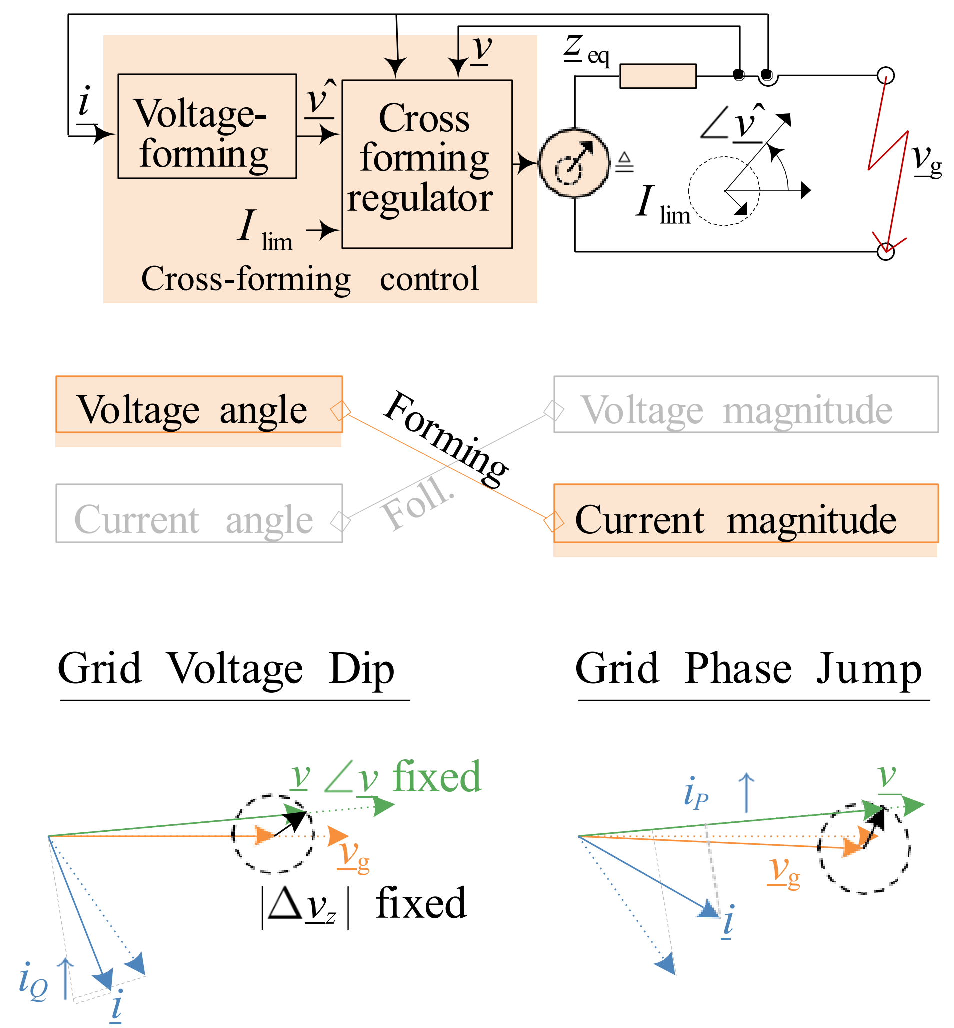
two principled remedies during saturation

① switch to current-forming = grid-following by imposing ∡ i

② cross-forming: impose ∡ v next to |i|, and let |v| adjust according to circuit laws

Courtesy Professor Dr Florian Doerfler University of Zurich

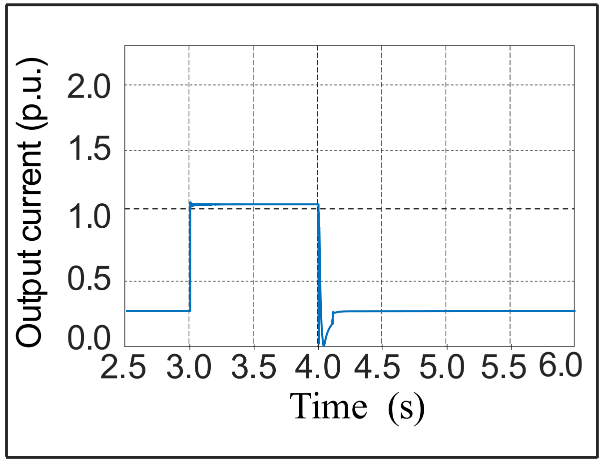
Cross-Forming Control

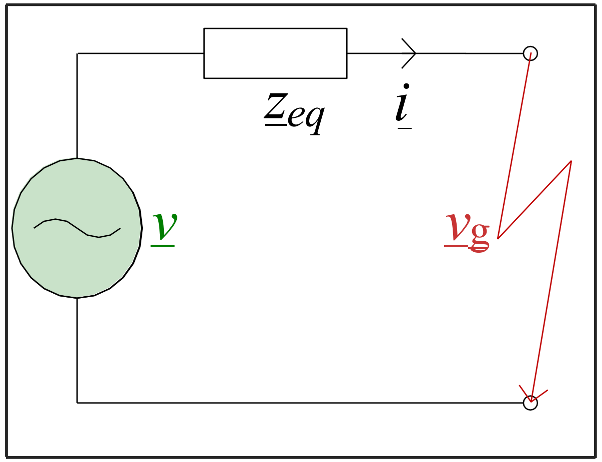


Courtesy Professor Dr Florian Doerfler University of Zurich

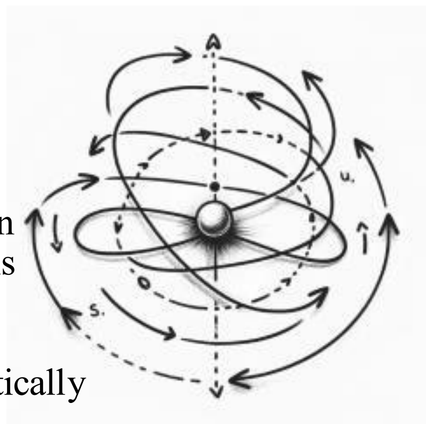
Conclusion using Cross Forming

Star Charge





If 'x' then system is almost globally asymptotically stable...



Current Limitation and Overcurrent Utilization

The proposed strategy **promptly** limits the current and protects the converter while fully utilizing its **over-current capability**.

Preserve Grid-Forming Capability

The strategy preserves **angle-forming capabilities** during a fault **despite current limitation.**

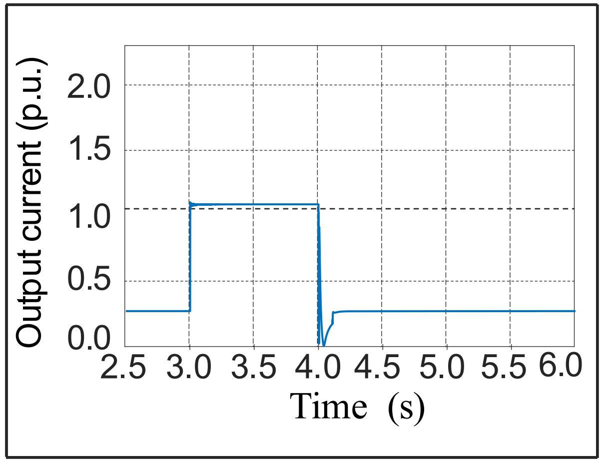
Transient Stability Guarantees

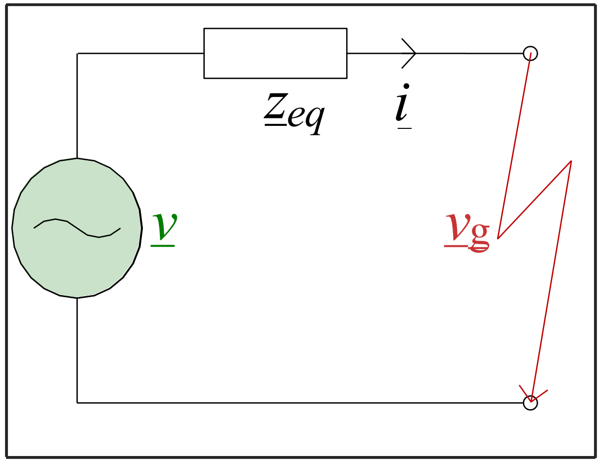
Decentralized stability conditions obtained for **converter-interfaced power systems** considering **current limitation.**

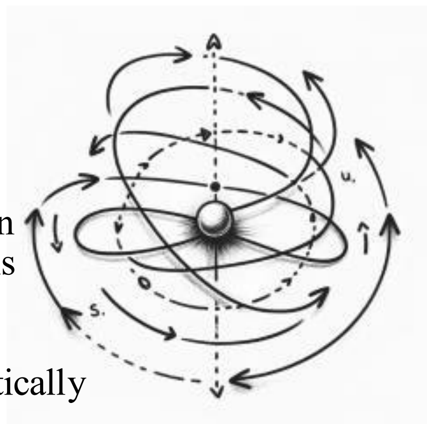
Courtesy Professor Dr Florian Doerfler University of Zurich

Conclusion using Cross Forming

Star Charge®







If 'x' then system is almost globally asymptotically stable...

Current Limitation and Overcurrent Utilization

The proposed strategy **promptly** limits the current and protects the converter while fully utilizing its **over-current capability**.

Preserve Grid-Forming Capability

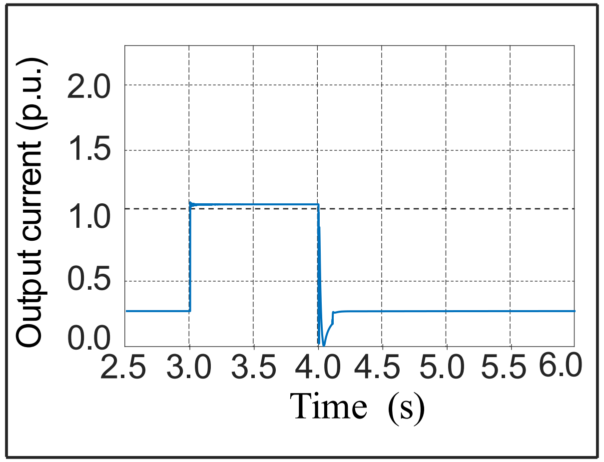
The strategy preserves **angle-forming capabilities** during a fault **despite current limitation.**

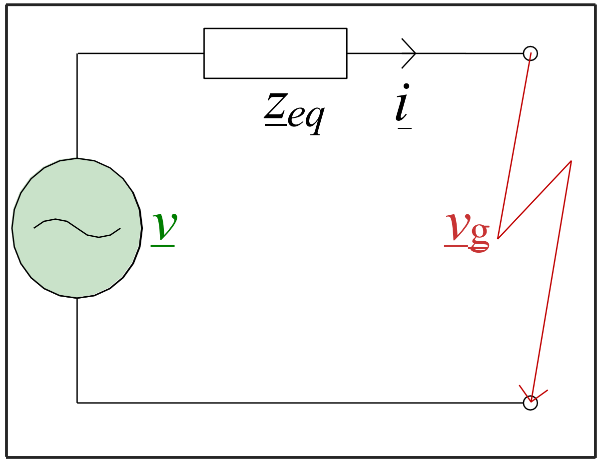
Transient Stability Guarantees

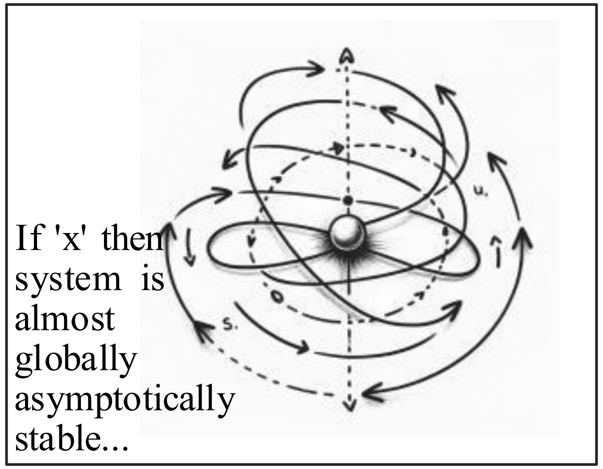
Decentralized stabil-ity conditions obtained for **converter-interfaced power systems** considering **current limitation.**

Courtesy Professor Dr Florian Doerfler University of Zurich

Conclusion using Cross Forming







Current Limitation and Overcurrent Utilization

The proposed strategy **promptly** limits the current and protects the converter while fully utilizing its **over-current capability**.

Preserve Grid-Forming Capability

The strategy preserves **angle-forming capabilities** during a fault **despite current limitation.**

Transient Stability Guarantees

Decentralized stability conditions obtained for **converter-interfaced power systems** considering **current limitation.**

Courtesy Professor Dr Florian Doerfler University of Zurich