PREVENTIVE AND EMERGENCY TRANSIENT STABILITY CONTROL

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STATEMENT OF THE PROBLEM

Action taken after the contingency inception

Emergency control

Dangerous operating condition; risk of instability if a severe contingency occurs.

Preventive control

Action taken before the contingency inception

Preventive and emergency control features

Preventive control :

- Designed by off-line simulations
- Modifies the operating conditions of the system
- Costs money even if contingency does not occur

Emergency control :

- Triggered only if contingency occurs
- Open-loop vs closed-loop emergency control

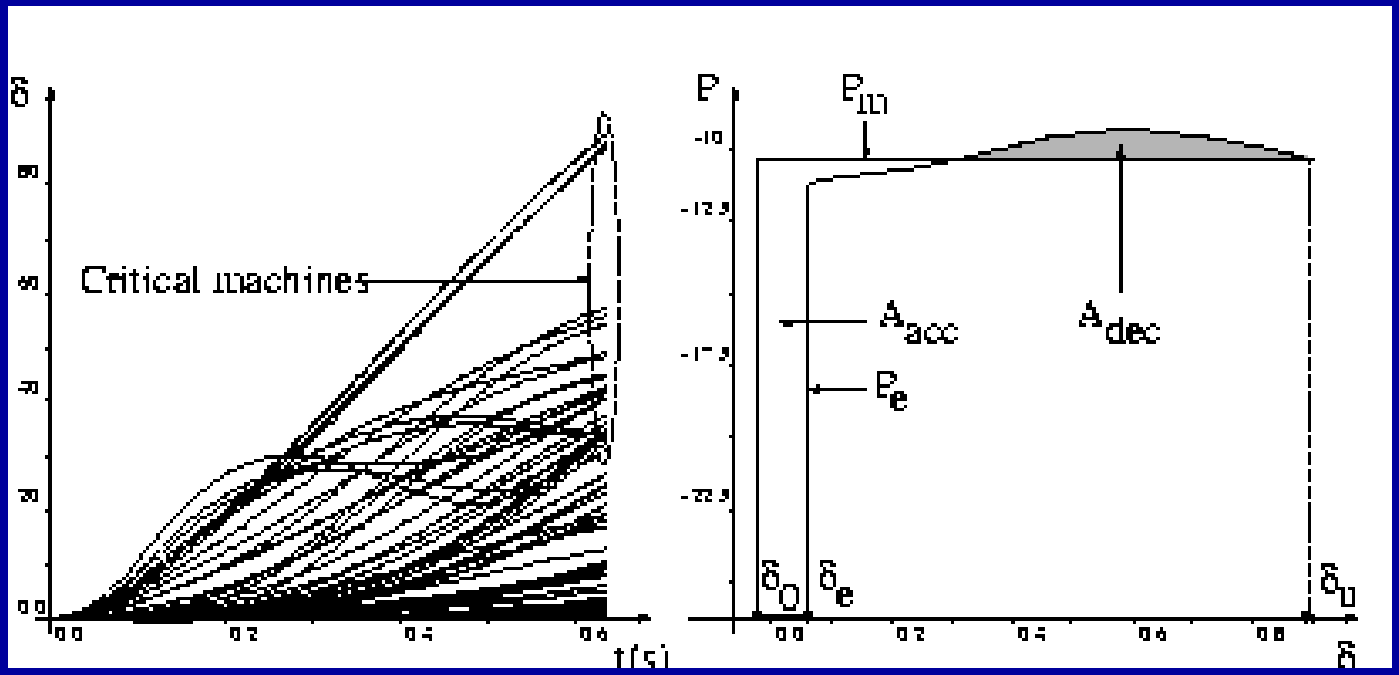
EXAMPLE OF EMERGENCY AND PREVENTIVE CONTROLS

- Test network : 88-machine EPRI test system C
- Only transient stability taken into account
- Contingency considered here : 3-Φ short-circuit cleared after 100 ms by opening of a line.

SIME approach to transient stability

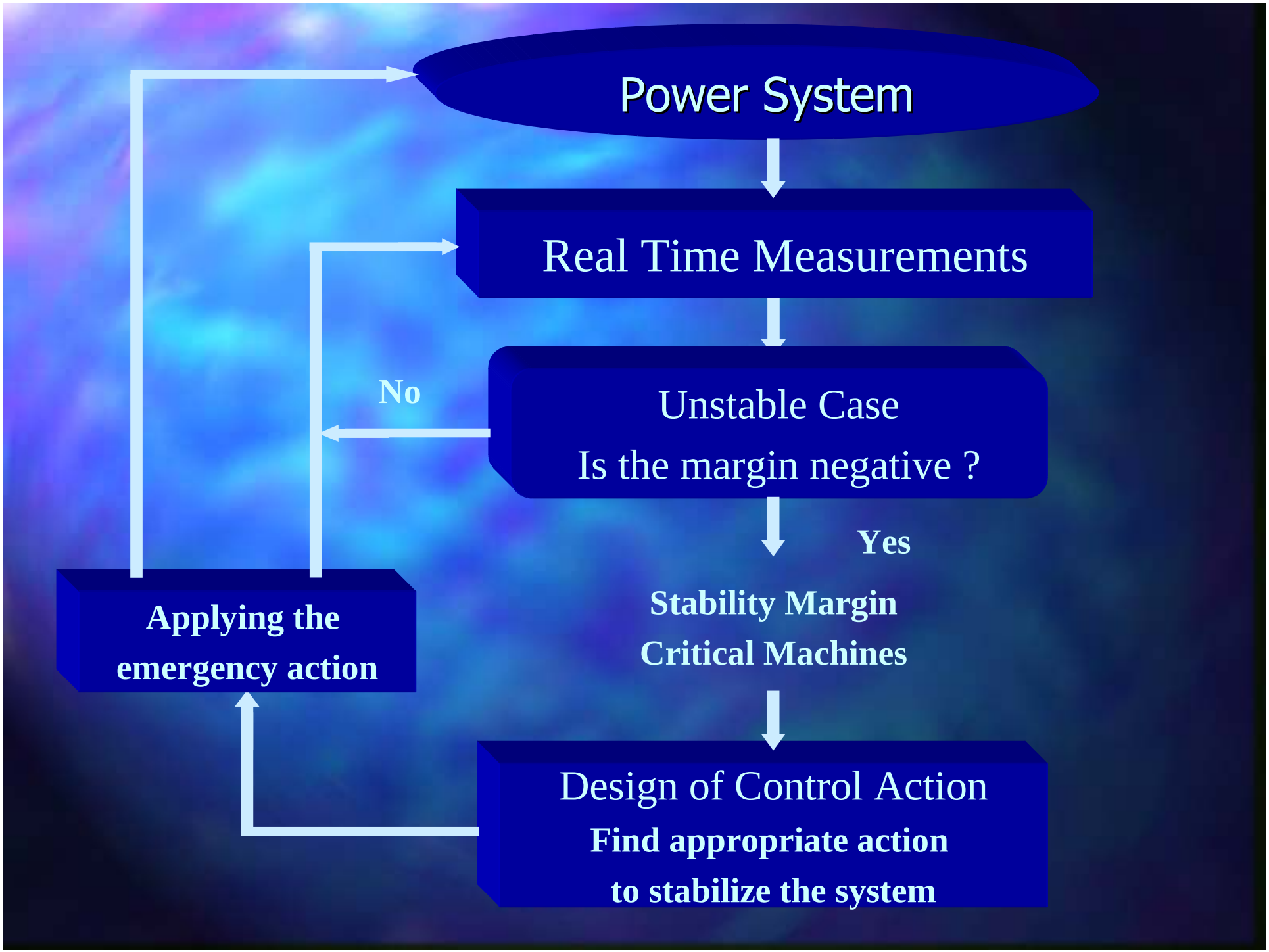
The **OMIB** (**O**ne **M**achine **I**nfinite **B**us):

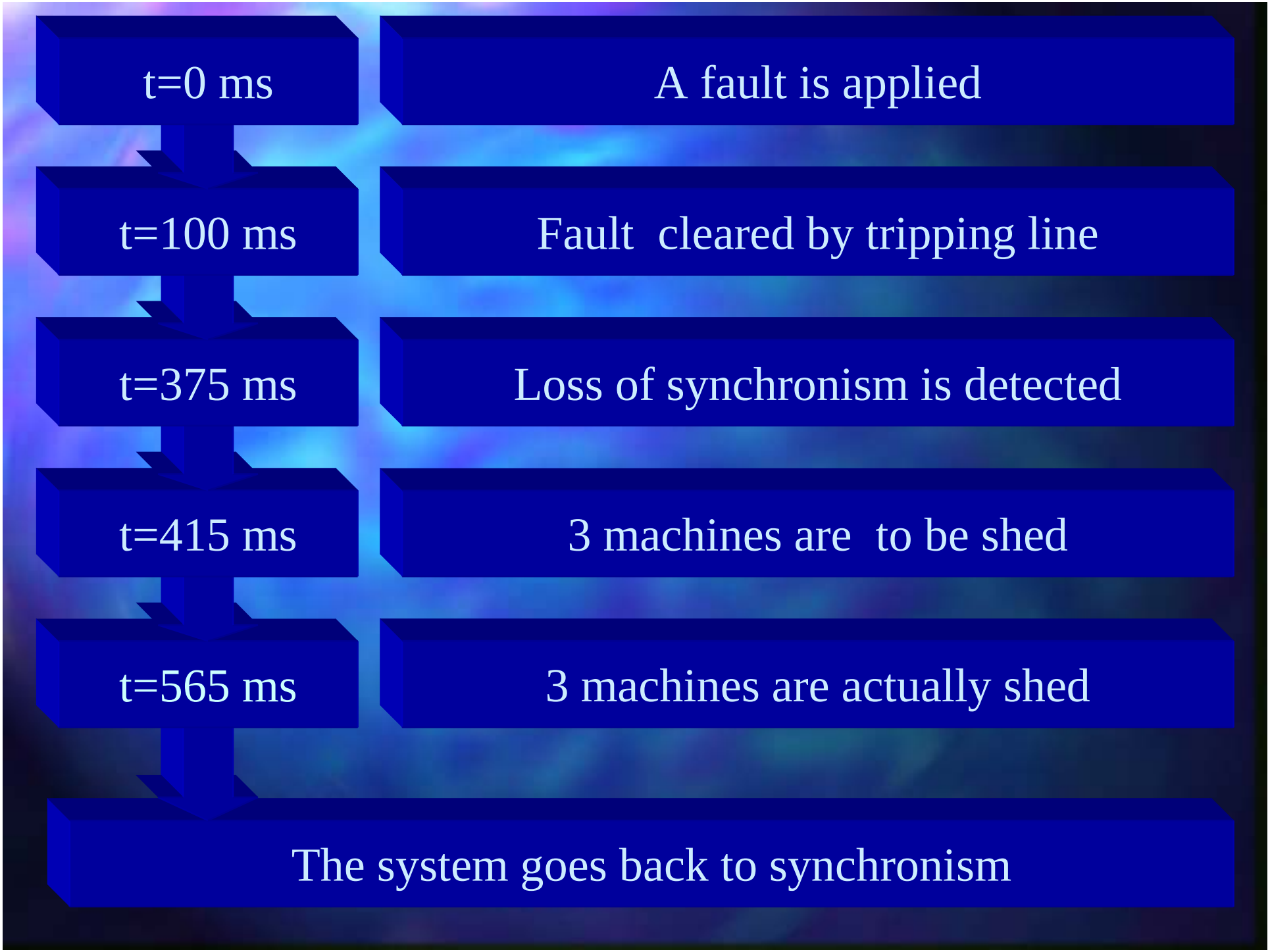
- reduces the multimachine power system dimensions
- assesses transient stability using the equal area criterion
- identifies critical machines and provides stability margins.



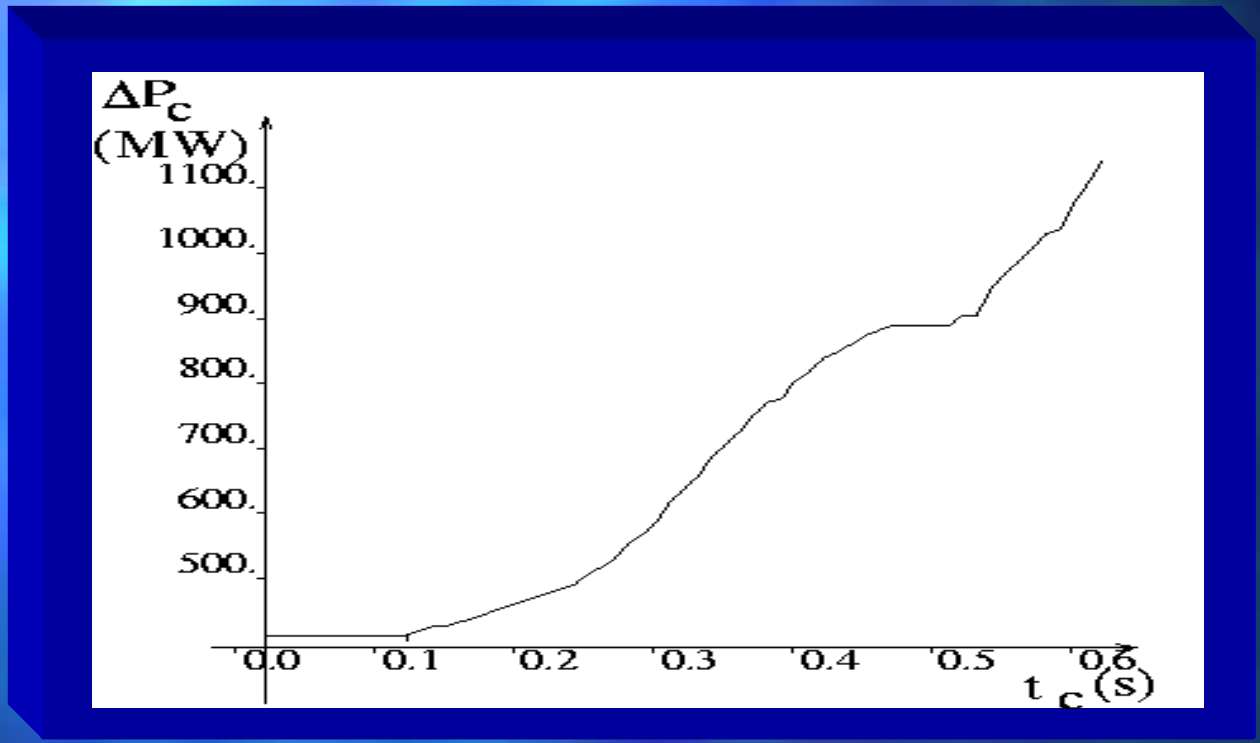
Preventive control

- 739 MW (2 %) **rescheduling** is enough to stabilize the system.
- The same procedure carried out on many contingencies leads to on-line preventive TSA&C.


Power System
Real Time Measurements
Unstable Case
Is the margin negative ?
No
Yes
Stability Margin
Critical Machines
Design of Control Action
Find appropriate action
to stabilize the system
Applying the
emergency action


t=0 ms
A fault is applied
t=100 ms
Fault cleared by tripping line
t=375 ms
Loss of synchronism is detected
t=415 ms
3 machines are to be shed
t=565 ms
3 machines are actually shed
The system goes back to synchronism

Variation of control size vs control time



- Size of control increases with the "time to control".
- Corrective action should be triggered as soon as possible.

Conclusions

- SIME provides efficient techniques for both preventive and emergency transient stability control.
- Technically emergency control is more difficult to achieve; but it opens avenues to new solutions for security problems in a deregulated market.
- Emergency control is not meant to replace preventive control but rather to complement it.