PREVENTIVE AND EMERGENCY TRANSIENT STABILITY CONTROL

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

Emergency control

Action taken after the contingency inception

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 (One Machine Infinite Bus):
- reduces the multimachine power system dimensions
- assesses transient stability using the equal area criterion
- identifies critical machines and provides stability margins.
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?

Yes
Stability Margin
Critical Machines

Design of Control Action
Find appropriate action
to stabilize the system

Applying the emergency action

No
A fault is applied
Fault cleared by tripping line
Loss of synchronism is detected
3 machines are to be shed
3 machines are actually shed
The system goes back to synchronism
- 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.