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POWER SYSTEM OPERATION AND CONTROL

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Wide Area Monitoring and Protection System for interarea oscillations suppression in the Italian power system

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Motivation

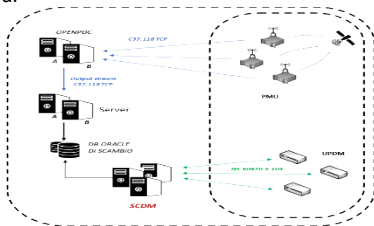
Operational experience shows that conventional monitoring approach is not sufficient to catch and prevent interarea oscillations, imposing mandatorily to control and monitor power system dynamic behavior ever closer to the real time and in some cases directly looking at their response. This can be achieved by increasing the sampling frequency of the measurement devices to allow prompt receiving of electrical quantities and state variables for power system monitoring and control.

Method/Approach

The WAMPAC system is a technology developed for real-time monitoring and defense of the large power grid. Terna has implemented an algorithm for estimating inter-area oscillations based on Dynamic Mode Decomposition that has the ability to intervene on the system when inter-area oscillations assume dangerous amplitudes. The alert is derived by real-time monitoring of data flows from PMUs and activation of a trigger based on three conditions to be fulfilled at the same time.

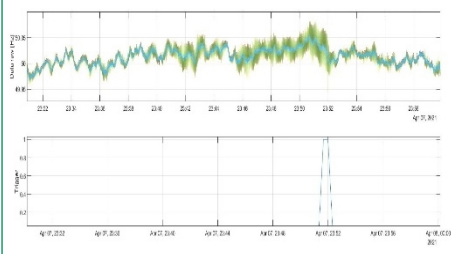
Objects of Investigation

The architecture of WAMPAC can be considered layered: PMUs placed at strategic points in an extended network take synchronous measurements (via GPS), which are transmitted to a phasor data concentrator (PDC), generating a single synchronized data stream output. This in turn is made available to a central server that analyzes them by DMD method and, in case of oscillations, sends the control signal for the activation of the countermeasures directly to the field.



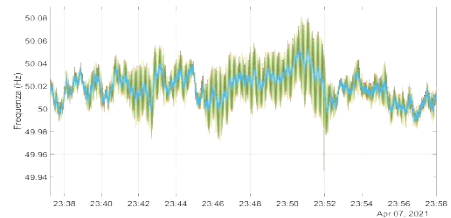
Tests Results

The picture depicts a real occurrence of a poorly damped interarea oscillation: the amplitude of the North-South Europe mode suddenly increases showing that it can be used as reliable indicator for the early identification of oscillations. At a certain time, there was the exceeding of the limits imposed for the transition of the trigger from 0 to the logical value 1 that implies the disconnection of a generation unit.



Discussion

As it can be seen from the Figure, after the logic intervention and the related disconnection of the generating unit, the oscillation is completely damped restoring a stable situation for the grid.



Conclusion

WADC identifies and monitors the stability of the Italian system and issues an alert to control room operators in case of sustained oscillations and an automatic stability logic intervention in case of dangerous oscillations. The approach taken is confirmed by the results and analysis reported.