

Accepted Manuscript

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Néstor Aparicio, Salvador Añó-Villalba, Enrique Belenguer,
Ramon Blasco-Gimenez

PII: S0378-4754(17)30005-8

DOI: <http://dx.doi.org/10.1016/j.matcom.2016.12.006>

Reference: MATCOM 4417

To appear in: *Mathematics and Computers in Simulation*

Received date: 25 October 2014

Revised date: 26 May 2016

Accepted date: 11 December 2016



Please cite this article as: N. Aparicio, S. Añó-Villalba, E. Belenguer, R. Blasco-Gimenez, Automatic under-frequency load shedding mal-operation in power systems with high wind power penetration, *Math. Comput. Simulation* (2017), <http://dx.doi.org/10.1016/j.matcom.2016.12.006>

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Automatic under-frequency load shedding mal-operation in power systems with high wind power penetration

Néstor Aparicio^{a,*}, Salvador Añó-Villalba^b, Enrique Belenguer^a, Ramon
Blasco-Gimenez^c

^a*Area of Electrical Engineering, Universitat Jaume I, 12071 Castelló de la Plana, Spain.*

^b*Department of Electrical Engineering, Universitat Politècnica de València, 46022
València, Spain.*

^c*Department of Systems Engineering and Control, Universitat Politècnica de València,
46022 València, Spain.*

Abstract

Countries with a limited interconnection capacity suffer substantial frequency variations after large incidents so they use automatic under-frequency load shedding schemes to arrest the frequency decay. Some of these countries such as Portugal, Spain and Ireland also have very high wind penetrations. This can cause additional frequency excursions due to generation time variability but also to the fact that variable speed wind turbines do not add directly their inertia to the power system. Thus several transmission system operators have announced new grid codes requiring wind turbines to provide frequency response.

In some scenarios, however, wind energy support may be detrimental to frequency control because it generates an extra energy that reduces decay and derivative but that cannot be maintained over time. These lower values of frequency decay and derivative are currently expected after a reduced incident or when conventional generation, which can maintain the extra generation, provides frequency support, so lead to low or no load shedding. This paper has studied, in particular, the effect of wind generation emulating inertia. A re-

*Corresponding author

Email addresses: aparicio@uji.es (Néstor Aparicio), sanyo@die.upv.es (Salvador Añó-Villalba), efbeleng@uji.es (Enrique Belenguer), r.blasco@ieee.org (Ramon Blasco-Gimenez)

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