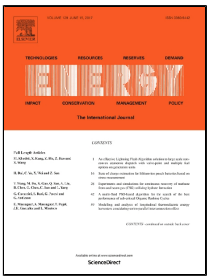
Accepted Manuscript



A Comprehensive Approach for Wind Turbine Generation Allocation with Accurate Analysis of Load Curtailment Using Nested Programming

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PII:	S0360-5442(17)30958-1
DOI:	10.1016/j.energy.2017.05.169
Reference:	EGY 10977
To appear in:	*Energy*
Received Date:	01 December 2016
Revised Date:	19 May 2017
Accepted Date:	28 May 2017

Please cite this article as: Alireza Jam, Morteza Mohammadi Ardehali, Seyed Hossein Hosseinian, A Comprehensive Approach for Wind Turbine Generation Allocation with Accurate Analysis of Load Curtailment Using Nested Programming, *Energy* (2017), doi: 10.1016/j.energy.2017.05.169

A Comprehensive Approach for Wind Turbine Generation Allocation with Accurate Analysis of Load Curtailment Using Nested Programming

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Abstract

Utilization of renewable energy based distributed generation such as wind turbine generation (WTG) provides proper opportunity for enhancement of the electric power distribution networks. However, appropriate integration of WTG in distribution networks is crucial for ensuring quality and reliability of power supply. This paper presents a novel and comprehensive solution methodology for optimum allocation of different WTG types. A nested programming based on imperialist competitive algorithm is used to minimize weighted sum of active power losses and system reliability indexes without violating the network constraints. The main optimization problem is formulated as a mixed integer nonlinear programming, while for accurate analysis of load curtailment, expected energy not supplied of the network is calculated by a set of nonlinear optimal power flow programming sub-problems. Four case studies are examined to demonstrate various aspects of the proposed approach using two 33-bus and 9-bus distribution networks. According to results, the case studies elaborate accuracy and validity of the proposed methodology that not only imply more precise results than conventional methods but also shows reliability evaluation satisfy technical constraints during different contingencies. This comprehensive methodology can be used as a suitable tool for different networks with various islanding rules.