

International Summit on Industrial Engineering

December 08-10, 2014 DoubleTree by Hilton Hotel San Francisco Airport, USA

Optimization of production and maintenance problem: Case study of wind turbine power generation

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Wind turbine system reliability is a critical factor in the success of a wind energy project. Consequently, maintenance is a crucial issue for such projects. In this paper, an integrated production and periodic maintenance policy with minimal repair at failures is proposed for a hybrid power generation system. We seek to establish an optimal integrated electricity production and maintenance plan over a finite planning horizon. It is important to do so according to the wind speed profile in order to guarantee that a random power demand (consumption) is satisfied given a target service level. In the context of energy planning, many researchers presented several techniques and methods which provide solutions to the multi-objective optimization problem for energy planning decisions. They have observed that Analytical Hierarchy Process (AHP) is the most popular technique followed by outranking techniques Promethee and Electre. Regarding renewable power generation systems reliability, some researchers studied the factors that contribute to the reliability deterioration of such systems; they concluded that in a significant part of the year, seasonal and spatial variability of wind, and to a lesser extent that of solar energy can yield low availability leading to an increase in unserved energy. Based on these literature reviews, we propose in this talk an integrated production-maintenance policy for wind turbine power generation. In fact, our approach consists in determining the best combination of energy production and maintenance effort, which minimizes the total cost while satisfying a random demand during a finite horizon with a given service level. This study is inspired from the background work, which models the influence of the production rate on the degradation level of the production system, and consequently on the maintenance strategy. A numerical example illustrates the use of the developed mathematical model.

Biography

Nidhal Rezg is a Doctor of Industrial Automatic from the National Institute of Applied Sciences (INSA) in Lyon in 1996. He obtained his Accreditation to supervise research (HDR) at the University of Metz in 2003. He was Professor at the Faculty of Engineering of the University of Moncton, New Brunswick, Canada, from 1997 to 1999 and Associate professor at the University of Metz until 2004. He currently holds the position of Professor of University. He's been director of LGIPM laboratory since October 2006. His research interests are the optimization of maintenance policies coupled to production, the optimal control SED. He is the author of sixty papers in international journals, director of 12 theses and 4 accreditations to supervise research.

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