

可再生能源发电

虚拟风场和风力机模拟系统的实验研究

窦真兰, 王晗, 张秋琼, 凌志斌, 蔡旭

电力传输与功率变换控制教育部重点实验室(上海交通大学)

摘要:

在不具备风场环境或风力机的条件下, 建立虚拟风场和风力机模拟系统, 对风力发电系统的研究具有重要作用。根据风速变化规律, 建立了基于谱密度分析的自回归理论的风速模型。在此风速模型基础上, 考虑涡流效应, 对叶片进行受力分析, 根据叶素理论和权系数分配叶素的方法建立风轮转矩模型, 利用转矩控制直流电动机模拟风力机, 搭建了虚拟风场和风力机模拟系统实验平台。虚拟风场的建立为虚拟风力机暂态或连续性实验提供了良好的基础。风力机模拟系统实验不仅验证了风轮转矩模型的准确性, 反映了风速变化时模拟输出风轮转矩的快速跟随性能, 而且可用于变速恒频风力发电系统的研究, 证明其控制策略的正确性。

关键词: 虚拟风场 自回归理论 风轮转矩 涡流效应 叶素理论 权系数分配 风力机模拟系统

Experimental Research on Virtual Wind Farm and Wind Turbine Emulator System

DOU Zhenlan, WANG Han, ZHANG Qiuqiong, LING Zhibin, CAI Xu

Abstract:

In a laboratory without the condition of actual wind farm or wind turbine, building a virtual wind farm and wind turbine emulator system is very important to the research of the wind energy generation system. The wind model of autoregressive theory based on spectral density analysis was proposed according to the variable rule of wind speed. The force on the blade was analyzed and the model of wind turbine torque was built using the blade element theory and the weight coefficient assignment for elements, considering the influence of vortex effect. The characteristic of the wind turbine was emulated by DC motor with torque control strategy. The experiment platform of virtual wind speed and wind turbine emulator was built. The virtual wind can provide good basis for the wind turbine transient or continuous experiment. The experiment of wind turbine emulator system not only confirms the correctness and superiority of the wind turbine model, reflects the rapid tracking performance of the emulated torque according to variable wind speed, but also is used in the research of variable speed constant frequency wind energy generator system, and verifies the correctness of the control strategy for variable speed constant frequency wind energy generator system.

Keywords: virtual wind farm autoregressive theory wind turbine torque vortex effect blade element theory weight coefficient assignment wind turbine emulator

收稿日期 2010-11-03 修回日期 2010-12-06 网络版发布日期 2011-07-15

DOI:

基金项目:

国家自然科学基金(50907040, 08DZ1200504, 08DZ2210502)。

通讯作者: 窦真兰

作者简介:

作者Email: zhenldou@126.com

参考文献:

本刊中的类似文章

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(375KB)
- ▶ [HTML全文]
- ▶ 参考文献[PDF]
- ▶ 参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

- ▶ 虚拟风场
- ▶ 自回归理论
- ▶ 风轮转矩
- ▶ 涡流效应
- ▶ 叶素理论
- ▶ 权系数分配
- ▶ 风力机模拟系统

本文作者相关文章

- ▶ 窦真兰
- ▶ 王晗
- ▶ 凌志斌
- ▶ 蔡旭

PubMed

- ▶ Article by Dou,Z.L
- ▶ Article by Yu,h
- ▶ Article by Ling,Z.B
- ▶ Article by Sa,x

