

南臺科技大學

機械工程系碩士班

碩士學位論文

雙軸串聯式單搖擺六桿風能傳動機構之
設計與製作

**The Design and Prototype of a Six-bar
Transmission with Two Serial Inputs and
Single Swing Axes for Wind Devices**

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摘要

根據中央氣象局所提供之資料，風的方向與角度會不斷改變，而導致小型風能發電機所擷取的能量低，從雙軸串聯式單搖擺六桿風能傳動機構之運動設計文獻中，發現雙軸串聯式單搖擺六桿風能傳動機構比其它傳統風能裝置，可擷取更多能量，因此本論文將會針對大臺南地區之氣象資料進行統計與分析，由大臺南地區之氣象資料得到風向改變之風能密度之平均值，而風向改變之風能密度即是我們所可以擷取之額外能量。接下來將現有風能裝置拆解成三個構成要素，分別為風能收集單元、動能傳遞單元與能量轉換單元，接著針對雙軸串聯式單搖擺六桿風能傳動機構之構造，我們列出其拓樸構造分析、自由度分析、作動情況分析、力量分析、核心機構傳動齒輪之決定、發電機傳動齒輪之決定、尾翼面積之計算，在機構之細部設計和配置設計方面，將會完成機構之軸承配置設計，和完成機構之配重和防水細部設計，並規劃出機構之整體組裝流程，接著用電腦模擬分析軟體，分析機構之剛性與強度，並得到此機構之最大變形量與安全係數。最後使用計算公式與離型機實際測試，得到雙軸串聯式單搖擺六桿風能輸出動能之理論值與實際測量值，並與永康地區之氣象資料進行整合分析的結果證實，雙軸串聯式單搖擺六桿風能傳動機構比其它傳統小型風能裝置，可增加所擷取進來之風能。

關鍵字：風能裝置、多自由度機構、機械設計。



ABSTRACT

According to the information provided by the Central Weather Bureau, the direction and angle of the wind will change constantly, resulting the capture energy by the small wind energy generators is low. From literature of the kinematic design of a six-bar transmission with two serial inputs and single swing axes for wind devices, we found the six-bar transmission with two serial inputs and single swing axes for wind devices can capture more energy than other traditional wind devices. Therefore, this paper will conduct statistics and analysis on the meteorological data of the big Tainan area. The average of the wind energy density that the wind direction change is obtained, and the wind energy density that the wind direction change is the extra energy we can capture. Then, the existing wind devices is disassembled into three components, respectively the wind energy collecting unit, the kinetic energy transfer unit and energy conversion unit. Then for the structure of the six-bar transmission with two serial inputs and single swing axes for wind devices, we list topological structure analysis, degree of freedom analysis, operating conditions analysis, strength analysis, decision of the core mechanism transmission gear, decision of the generator transmission gear, calculation of the tail area. In the detailed design and configuration design of the mechanism, the bearing configuration design of the mechanism will be completed, and the weight and waterproof detail design of the mechanism will be completed, and the overall assembly process the mechanism will be planned. Then use computer simulation analyze the software, analyze the stiffness and strength of the mechanism, and obtain the maximum deformation of the mechanism and safely factor. Finally, using the calculation formula and the actual test of the prototype machine, the theoretical and actual measured values of the six-bar transmission with two serial inputs and single swing axes for wind devices kinetic energy output are obtained, and the results of integration analysis with the meteorological data in Yongkang area confirm that the six-bar transmission with two serial inputs and single swing axes for wind devices can increase the captured wind energy compared to other traditional small wind energy devices.

Keyword : Wind device, Hybrid mechanism, Mechanical design

