灰色預測在倒單擺系統之應用
The Grey Predictor Control in Inverted Pendulum System

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摘　要

在本篇論文中，吾人藉由灰色理論提出灰色預測控制器（GPC），應用於倒單擺系統中。在GPC模式中，系統之輸出或狀態，藉由GM（1,1）灰模式做即時預測，以便將其結果，做爲下一，控制信號之參考。主要的觀念是適當步距的系統輸出或狀態預測值可提供系統之未來趨勢，藉此資訊可調整控制信號使系統輸出達到所要求之規格。基本上大的預測步距易導致長的上升時間及穩態誤差，然而小步距預測卻可能會發生振盪，雖然系統響應較快。吾人將提供一簡單之法則來決定預測之步距。一倒單擺及線性系統將用來說明此之理論之可行。

Abstract

In this paper, a simple but powerful grey predictor controller(GPC) based on the newly-developed grey theory is proposed. In GPC mode, the behavior of the system output (or states) is estimated on line based on the well-known grey model, of which the type of GM(1,1) is used here. The main idea is the proper predict step of system output (or states) can offer the trend of the output and this information can be used to adjust the control signal such that the behavior of the output is satisfied the specification. Basically, the large predict step increases the rise time and may cause steady state error, while for using small one, it may cause oscillation of system output, but has fast response. In designing GPC, there is a problem to be solved that is how to determine the predict step. A simple rule will be applied to solve the problem and the GPC has been successfully demonstrated on an simulated inverted pendulum system and a linear process.