

以類神經網路推測機械手臂與環境之接觸力

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摘要

在工業生產過程中，往往要求機械系統能夠作高速的運作，因此機件間常產生許多的碰撞與接觸，造成機械系統的不穩定。爲了克服此問題，在控制過程中常加入一個補償項，用以消除碰撞時周邊環境對其產生的衝擊力。本文利用倒傳遞類神經網路求解機械系統的接觸力，取代傳統接觸力的求取方法。神經網路除了具有即時運算的特色之外，並且具有學習能力，可應用於各種不同材質的機械系統，在不同的接觸情況下力量的求取。此外，由於訓練範例是由接觸力學理論求得，因此研究的過程中，亦詳細地討論了剛體運動的模擬和剛體碰撞模型，並選取合適的剛體碰撞模型。最後並且使用順應接觸模型取代剛體碰撞模型，求取碰撞時的接觸力。

關鍵字：倒傳遞網路、順應接觸模型、順應接觸模型

Abstract

In industrial manufacturing process, it is often to require the ability of high-speed operations of the mechanical system. During these operations, there exist contacts and impacts between mechanical components and cause instabilities of the system. To overcome these difficulties of instability, a control algorithm is required to compensate the influence of contacts and impacts with the environment. In this research, we use artificial neural networks instead of traditional approaches to get the contact forces of mechanical systems. The artificial neural networks have the characteristics of real-time computing and the ability of learning, so that they can be used in this study to get contact forces. We apply the networks for mechanical systems in the different contact situations and in the cases of system components made from different materials. All of the training examples are obtained from the theory of contact mechanics. The results can be applied to the simulations of manufacturing processes, robot manipulations and assembly operations.