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碩士論文

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單缸二行程引擎循環變異現象探討

Study of the Cyclic Variation of Single Cylinder Two－Stroke Engines

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摘　要

二行程引擎由於其特殊的驅氣方式，在低負載時循環變異現象很嚴重，引擎運轉不穩定，碳氫化合物的污染排放亦顯著提高。但這種不穩定燃燒並非完全隨機出現，而有一定的規律可循。這主要是二行程引擎的驅氣掃氣特性使前一個循環的殘留氣影響到這個循環。本文主要目的是嘗試以傳統引擎循環模擬分析的方法來探討殘留氣對循環變異的影響。

在本文中建立一個曲軸箱驅氣式單缸二行程引擎的循環模式，利用該模式來模擬引擎在低負載下的運轉狀況，並可產生具有循環變異特性的結果。在文中探討了進氣量、火焰傳播速度、點火成功條件、熱傳量、不同燃燒化學反應及驅氣模式對循環變異的影響。計算結果顯示，負載改變會影響殘留氣比例，這會影響燃燒狀況，造成間隔燃燒現象。增加火燄速度則會使燃燒狀況較好，在低負載時會影響間隔燃燒現象。點火成功條件越嚴苛，沒有燃燒的循環數目會增加，但燃燒狀況也特別好。熱傳量增大則會使燃燒狀況較差，但會使下個循環有較多的可燃氣，進而改變間隔燃燒現象。當量比爲1.0、1.1時燃燒狀況最好，但會產生較嚴重的循環變異現象。HC污染排放會隨著未燃燒循環的增加而增多，CO污染排放則相反。完全混合模式能模擬出循環變異現象，完全驅氣模式則無法模擬出循環變異現象。改變不同參數可得到類似混沌過程的循環變異現象。

ABSTRACT

Because of the special scavenging process, the cyclic variation of the two-stroke engine is very serious at low load condition. However, this kind of unsteady condition doesn't appear stochastically; there are some rules that we can observe. The combustion of a cycle is affected by the residual gas of pre-cycle, which is the results of the scavenging characteristic of the two-stroke engine. The main objective of this paper is to study how the residual gas influencing the cyclic variation using the traditional engine cyclic simulation analysis method.

In this paper, we establish the cycle model of a single cylinder two-stroke engine of crankcase scavenging type to simulate the low load condition. We find that the cyclic variations is influenced by the throttle the flame propagation speed, the condition of successful ignition, the heat transfer, the different chemical reaction on combustion and the scavenging models. Results of simulation show that the variation of load can influence the ratio of residual gas, which in turn affect the flame speed and results in skip combustion. Besides, if we increase the flame speed, then the combustible situation will be better; it also can influence the phenomenon of skip combustion at load condition. Moreover, the stricter the condition of successful ignition is, the better the combustion is. However, the cyclic number of combustion will increase. The combustion condition will be worse when the heat transfer increase, which will let the next cycle have more combustibility gas, and then change the phenomenon of skip combustion. Th combustion condition is the best on when its equivalence ratio are 1.0 , 1.1 ; on the other hand, it will result in more serious phenomenon of cyclic variation. The HC emission will increase with the uncomplete combustion cycle, but the CO emission is opposed to it. The perfect mixing model can simulate the cyclic variation, yet the perfect displacement model can't. Anyway, if we change the different parameters, then we can get the cyclic variation of similar chaotic process.

目　錄