

小型競賽車輛Go-kart安全防護設計之探討

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摘要

小型競賽車輛Go-kart在國際上乃一普遍之娛樂與刺激的競賽，且F1方程式賽車中許多車手皆由參加Go-kart競賽而起家。一般而言，一個國家之車輛工業發展與參與賽車之人口數成正比。競賽型Go-kart之設計必須遵守「非常簡易」之原則，意味著車上不得有任何多餘之零件。然而，競賽型Go-kart之設計有時甚至比標準車輛之設計還要複雜。雖然實驗測試至今仍是最普遍且最為廣泛應用之方法，但是近年來，數值模擬已經迅速地發展成為一項輔助工程設計之方法。由於Go-kart並未裝配差速器與避震器，故車架必須在Go-kart行駛時吸收產生的負荷，並需負責負載轉移以彌補無差速器之不足。因此，Go-kart車架之扭轉勁度會明顯地影響一部Go-kart之操控性能。另一方面，雖然Go-kart是一項很安全之娛樂，但是每一年仍有許多意外事件發生，尤其是Go-kart撞擊到一靜止的物體，或是Go-kart在行駛時撞擊到另一部亦在行駛中之Go-kart。因此，Go-kart之碰撞性能亦非常重要。本論文乃執行國科會提升私校研發能量專案計畫整合型計畫「小型競賽車輛之自行設計與研製」之一部份，首先對一部競賽型Go-kart之設計與製造程序作一探討，包括外型設計、空氣動力學分析、車架結構之設計、碰撞性能之分析、動力傳動系統之設計、與Go-kart行駛時之動態分析。本論文主要著重於如何改善Go-kart車架之扭轉勁度、設計良好之Go-kart保險桿以在碰撞時吸收較多的能量、以及Go-kart整車在高速撞擊下之碰撞分析。本研究之數值分析乃利用非線性有限元素軟體LS-DYNA 3D進行。Go-kart車架之扭轉勁度靜態分析中，吾人建構10種裝配不同額外桿件與4種不同寬度之車架模型。結果顯示，在10種裝配不同額外桿件之模型中，將一傾斜額外桿件裝配於中央管件前方之模型為最佳。而且，扭轉勁度與寬度之增加成正比關係。在碰撞測試之分析中，吾人探討影響Go-kart保險桿碰撞性能之三個因素，包括前上保險桿與水平面之間的角度、保險桿之厚度與管徑，並分別量測每一組測試之減速度、侵入量、與能量吸收。結果顯示無論是前方或側邊碰撞測試中，最佳的改善方式都是增加管徑。在Go-kart整車之撞擊分析中，吾人探討在三個不同速度下之撞擊，包括CIK-FIA認證碰撞測試中所使用之10.7km/hr、以及FIA對安全緩衝器之碰撞測試中所使用之60km/hr與80km/hr，並觀察Go-kart之動態行為。由於目前國內缺乏製造合格Go-kart之能力，因此吾人相信本研究可提供給車廠在未來設計製造新的Go-kart時作參考。

關鍵詞：Go-kart，扭轉勁度，能量吸收，碰撞性能，LS-DYNA 3D

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