

大学生方程式赛车车架有限元优化分析

摘 要

本文是以大学生方程式赛车的车架作为研究对象，车架是方程式赛车的主要组成部分，基本上所有赛车零部件都要安装在车架上。在赛事中，作用在车架上的有路面不平产生的激励、每部分总成的重力等其他力，因此性能好的车架对比赛的成绩会有很大的帮助。

为了使赛车的性能能够在满足安全性的前提下得到充分的提高,有必要对车架的结构和安全性进行初步的研究和分析。首先，要考虑到规则的要求，人机工程学，重要总成和部件的安装，从而大致确定赛车总体布置之后，开始对车架的结构进行拓扑优化，通过拓扑优化的得到一个质量较轻的车架结构，后续对优化过的车架模型进行强度、刚度分析，目的是确保车架在赛车的使用过程中不发生断裂失效或大的变形；还需要对车架进行模态分析，验证在比赛和试验工况下不会由于激励发生共振现象。在强度刚度以及固有振动频率都达标的情况下，尽可能采取降低非重要管件厚度的方式，来减少车架的重量，可以达到更好的动力性。

关键词：大学生方程式赛车；车架；有限元分析

Abstract

This article takes the frame of a college student's formula car as a research object. The frame is the main component of a formula car. Basically, all racing parts must be installed on the frame. In the competition, there are excitations caused by uneven road surface, gravity of each part assembly and other forces acting on the frame, so a frame with good performance will greatly help the performance of the race.

In order to make the performance of the car fully improved under the premise of satisfying safety, it is necessary to conduct preliminary research and analysis on the structure and safety of the frame. First of all, it is necessary to consider the requirements of the rules, ergonomics, installation of important assemblies and components, so as to roughly determine the overall layout of the car, and start to optimize the structure of the frame. Through topology optimization, a lighter weight is obtained. Frame structure, follow-up strength and stiffness analysis of the optimized frame model, the purpose is to ensure that the frame does not break or fail during the use of racing cars or large deformation; also need to carry out modal analysis of the frame to verify Under competition and test conditions, resonance will not occur due to excitation. In the case where the strength stiffness and natural vibration frequency are up to the standard, it is possible to reduce the thickness of the non-essential pipe fittings as much as possible to reduce the weight of the frame and achieve better dynamic performance.

Keywords: College students' formula; The frame; The finite element analysis

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