4110 柴油机复合消声器的设计

摘要：发动机噪声一直是工业社会的副产品，其中排气噪声占主导地位，属于低频噪声，而最直接的办法便是安装消声器。设计一款高消声性能，低压力损失的消声器成为当前噪声控制领域的热门话题。前人的设计方法便是依靠经验和实验进行模拟，再基于模拟结果进行设计改进。

本文针对 4110 柴油机的一些基本参数进行消声器的设计，确定出消声器结构类型为复合消声器。出入口管直径为 62mm。消声器容积为 16.6L，扩张比为 0.1，消声量为 26dB，外形尺寸 L 和 D 分别为 574mm 和 192mm。消声器腔数 n 为 3，各腔长度 L_1、L_2 和 L_3 分别为 135mm、300mm 和 135mm。插入管布置方式为中心对正式，出、入口长度为 34mm 和 68mm。并依据消声器参数进行三维建模，利用有限元法，对计算区域进行网格划分和网格质量检查，设定物理模型，边界条件，多孔介质和求解方法后，对其流体区域进行标准初始化和迭代计算，得到消声器内部流场计算结果。分析其内部多物理场分布，总结其流体力学性能，计算出其压力损失值为 4522Pa，并对消声器后续结构优化提出构思。

关键词：复合消声器；有限元；流体力学性能；计算流体动力学

Design of compound muffler for 4110 diesel engine

Abstract： Engine noise has always been a by-product of industrial society, in which exhaust noise dominates and belongs to low frequency noise, and the most direct way is to install muffler. The design of a muffler with high noise attenuation performance and low pressure loss has become a hot topic in the field of noise control. Previous design methods rely on experience and experiments to simulate, and then based on simulation results to improve the design.

According to some basic parameters of 4110 diesel engine, this paper designs the muffler, and determines that the muffler structure type is composite muffler. The diameter of inlet and outlet pipe is 62mm. The volume of muffler is 16.6L , the expansion ratio is Zero point one , the noise reduction is 26dB, and the boundary dimensions L and D are 574mm and 192mm respectively. The number of cavity n of muffler is 3, and the length of each cavity L_1, L_2 and L_3 are 135mm, 300mm and 135mm respectively. The insertion pipe is arranged in a center to center manner, with the length of the inlet and outlet being 34mm and 68mm. According to the parameters of the muffler, the three-dimensional model is built, and the finite element method is used to mesh the calculation area and check the mesh quality. After setting the physical model, boundary conditions, porous media and solution methods, the standard initialization and iterative calculation are carried out for the fluid area, and the calculation results of the internal flow field of the muffler are obtained. The pressure loss of the muffler is 4522pa by analyzing its internal multi physical field distribution, summarizing its hydrodynamic performance, and putting forward the idea of the subsequent structure optimization of the muffler.

Keywords: Composite silencer; Finite element; hydrodynamic properties; computational fluid dynamics