几何参数化计算的柴油机冷却风道键合图模型Geometry Based Parametric Bond Graph Model of Diesel Cooling Fan-channel Analysis

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关键词： 柴油机〓冷却系统〓风扇〓流道〓空气流量〓键合图

摘　要： 为确定柴油机散热系统的空气流量及空气流速分布规律，以研究散热性能和风扇风道几何参数之间的关系，建立了风扇风道几何尺寸参数化计算的冷却风道键合图模型。通过分析风扇的尺寸和空气动力性能，应用键合图方法分析风扇风道的功率损失，建立了系统模型，系统模型参数均为元件几何参数及空气特性参数，提出了散热器出风口风速分布预测方程，实现了以风扇转速为输入的散热器风道的流量计算及出风口风速分布预测。样机的现场风速测量实验表明，风速分布预测的误差均值为0.87%，误差方差为0.0052，风扇风道流量模型可作为冷却系统空气流量的估算方法。A bond graph model was established for the air-flow calculation of the diesel engine's heat dissipation system, to find out the relations between the design parameters and system's heat dissipation performance, especially when there was a lack of supportive data. By overall consideration of influences of the fan's parameters and the aerodynamics on the system's final performance, the bond graph was applied to calculate the power-loss during the process. Then a mathematic model of power flow with the design parameters of geometric parameters and air characteristics, where the flow-rate of the radiator's air duck could be calculated according to the fan's rotational speed. Formula of air speed distribution was also proposed that matched the data from field test. The bond graph model of the fan-channel is proved to be an effective estimation method of flow rate.

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