

Noise and Vibration Analysis for Automotive Radiator Cooling Fan

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Abstract. This paper presents to analyse the noise and vibration of automotive radiator specifically focused on its cooling fan for different fan condition and different coolants use which are Ethylene Glycol (EG) water-based and Titanium Oxide (TiO₂) nanofluid. Noise source identification is carried out by utilizing sound intensity mapping method while an accelerometer is used in order to measure the vibration results. Both of these experiments are conducted when the fan was in static and working conditions. The maximum cooling fan speed for working fan detected by a tachometer for EG water based is 1990 rpm while TiO₂ nanofluid is 2030 rpm. The speed is different due to the different physical properties such viscosity of each coolant have where TiO₂ nanofluid has lower viscosity than EG water-based. The maximum sound power level produced by EG water-based is 53.73 dB while TiO₂ nanofluid is 101.94 dB. Meanwhile, the vibration frequencies of EG water-based are higher than TiO₂ nanofluid. The noise level is increasing with cooling fan speed but decreasing the vibration frequency. Other than study the noise and vibration of automotive radiator, this research also analyzed the potential application by using nanofluid due to its many great properties according to its major use in heat transfer enhancement. As conclusion, nanofluid as a radiator coolant could improve of heat transfer rate, but also could reduce the presence of vibration in automotive cooling system

1. Introduction

A typical automotive engine cooling system consists of a radiator, cooling fan, water pump, coolant reservoir, thermostat, heater core and necessary plumbing for both the radiator and heater core. This study focused on car radiators as heat exchangers that used diversely in automotive industry for cooling internal combustion engines. Radiator cooling fans is a device that works to pull air through a radiator to regulate the engine temperature. However, this operating cooling fan has been known as a major contributor to noise in a vehicle other than engine. It became more crucial to figure out a