CURF
Clemson University Research Foundation

Optimized Radiator Fan Array for Reduced Power Consumption (2014-030)

Minimizes Energy Usage and Improves Cooling System Performance

Market Overview

This radiator fan system uses an optimization algorithm to control fan and motor speed resulting in improved fuel and power consumption. Due to a major call from U.S. regulatory committees to have a more aggressive fuel efficiency standard in sport utility and pickup trucks, researchers around the globe have been pushing to have weight reductions or optimize engine efficiency to decrease automobile power consumption. Typically control of the radiator fan relies upon the cooling system fluid temperature. However, this approach poses problems as the coolant can be overcooled and the process is limited by the thermostat for engine cooling. Researchers at Clemson University have developed a cooling system for internal combustion engines that removes waste heat to ensure a normal combustion process. The design includes an optimization algorithm that controls multiple electric radiator fans for improved cooling system performance through precise regulation of the number of active fans and their respective speeds.

Application

Cooling systems for gasoline and diesel engines; vehicles

Stage of Development

Validated Prototype

Advantages

- Lowers fuel consumption, reducing emissions
- Improves cooling system performance, resulting in greater vehicle fuel economy and meeting CAFE standards
- Incorporates smart operation by replacing mechanical radiator fans with computer controlled servo-motor actuators, reducing power consumption by 50 percent compared to conventional systems

Technical Summary

This invention uses a mathematic approach for controlling a multiple radiator electric fan matrix to minimize energy usage for subsequent efficiency gains. The optimization algorithm regulates the electric fan matrix and determines the best combination of electric motor shaft speed and the number of operating axial fan motors. Prototype implementations demonstrate varying fan and speed combinations in order to cool a thermal loaded engine and the use of the mathematical approach. The results verify that this optimization control strategy reduces the fan matrix power consumption by up to 67 percent for the specified thermal load. This creates an improvement in cooling system performance that leads to greater vehicle fuel economy and satisfaction of legislated mobility standards.

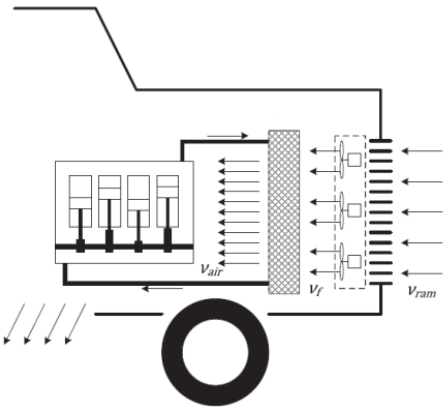

Figure 1: Illustration of the multiple electric fans set-up

For More Information Contact: Andy Bluvas | bluvasa@clemson.edu | (864) 656-5157 | CURF Reference No. 2014-030

App Type	Country	Serial No.	Patent No.	CURF Ref. Number	Inventors
Utility	United States	14/690,694	NA	2014-030	Tinawei Wang, John R. Wagner, Georges Fadel, Amit Jagarwal

About the Inventors

Dr. Georges Fadel is a Professor & ExxonMobil Employees' Chaired Professor of Mechanical Engineering at Clemson University. He earned his Ph.D. from Georgia Tech and taught there prior to joining Clemson. Dr. Fadel is the co-director and founder of Clemson Research in Engineering Design and Optimization (CREDO) is a member in several professional organizations. His research interests focus on design methodology and automation, optimization, CAD, rapid and virtual prototyping, and IT issues in design.

Dr. John R. Wagner is a Professor of Mechanical Engineering at Clemson University. He earned his Ph.D. in mechanical engineering from Purdue University. Prior to joining Clemson, he was an engineer at Delphi Automotive Systems. Dr. Wagner joined Clemson in 1998 and has since established the multi-disciplinary Driving simulator Laboratory and the Rockwell Automation Mechatronics Educational Laboratory. His research interests include nonlinear and intelligent control theory, design of multi-domain mechatronic systems, diagnostic and prognostic strategies, and applications to automotive/ transportation and mechatronic systems.

For More Information

To learn more about this technology, please contact:

Andy Bluvas
Technology Commercialization Officer
bluvasa@clemson.edu
(864) 656-5157