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Heat transfer enhancement in car radiators by using rectangular vortex generators

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Statement of the Problem: There is an increasing demand for more powerful engines in relatively small spaces which creates a problem of insufficient rates of heat dissipation in automotive radiators. Heat absorbs considerable amount of energy about 30% generated by the engine. Inadequate heat dissipation can result in the overheating of the engine, and that causes corrosion and metal weakening of engine parts. To minimize the stress on the engine because of heat generation, automotive radiators must be redesigned. The purpose of this study is to minimize the stress on the engine and lighten automotive component because of heat generation, and to make automotive radiators more compact while maintaining important level of heat performance. Compactness plays significant role in heat exchanger performance; economy in manufacturing and operating costs, energy conservation and for ecological reasons.

Methodology & Theoretical Orientation: Heat transfer increases as we increase the surface area of the radiator fins. Modern design can dissipate the same and/or more heat by using vortex generators in radiator fins. Rectangular vortex generators disturb the flow field and provide swirling flow which causes a heavy exchange of core and wall fluid.

Findings: Vortex generators decrease the wake region size and increase the intensity of secondary flow. The channel with the rectangular vortex generators increases the heat transfer performance of radiator about 55.8% compared to rectangular channel without vortex generators. The parameters of vortex generators have large effect on heat transfer performance. Length, height, and wings angle attack play a key role in determining the heat transfer performance. For the studied case better performance obtained when wings attack angle was 450 and vortex generators' height and length was half of the channel height and length.

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