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CFD Analysis for Performance Enhancement of Turbocharger

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ABSTRACT

The purposes of this research project is to increase the current engine's power and torque. This research effort has involved the modification of compressor impeller and turbine impeller. The compressor on this turbocharger has two impellers that face opposite directions. The turbocharger boosts the engine's input pressure with this change by compressing the air twice throughout the course of a two-stage procedure. As input pressure rises, more gasoline is needed to generate more power and torque. This adjustment also allows for the reduction of the engine. Downsizing refers to a reduction in engine size while maintaining the same power and torque. Because this change boosts power without affecting engine size, the turbocharger is the only component that may be changed.Another option to approach this research endeavour is to use an axial flow turbine rather than a radial flow turbine. While radial turbines need high exhaust gas velocities to spin their shafts at the same 1,00,000 rpm, axial flow turbines need low exhaust gas velocities. By forcing the exhaust gases into the turbine wheel directly, as opposed to radial type turbines, which drive the exhaust gases from the side of the turbine and then around the perimeter, producing more heat inside the turbine casing, it is clear that axial flow turbochargers are more effective. An 1800CC engine with four cylinders is used in this research project's engine calculations. The turbocharger was designed using CATIA, while ANSYS CFD was employed.

Keywords –Impeller, Turbine, Compressor, Power, Torque,

INTRODUCTION

A turbocharger is a force-induction device powered by exhaust gas that increases the power output of an internal combustion engine (IC) by forcing more air into the IC engine cylinder. Although adding a turbocharger will raise the cost of the vehicle, this approach is likely to be advantageous for powerful engines and circumstances when the engine requires more torque, such as racing automobiles and heavy-loaded vehicles. The turbocharger idea is also helpful when engine reduction is important. Power needs to be increased in the current engine, but as engine size increases, so does the weight of the engine as a whole.

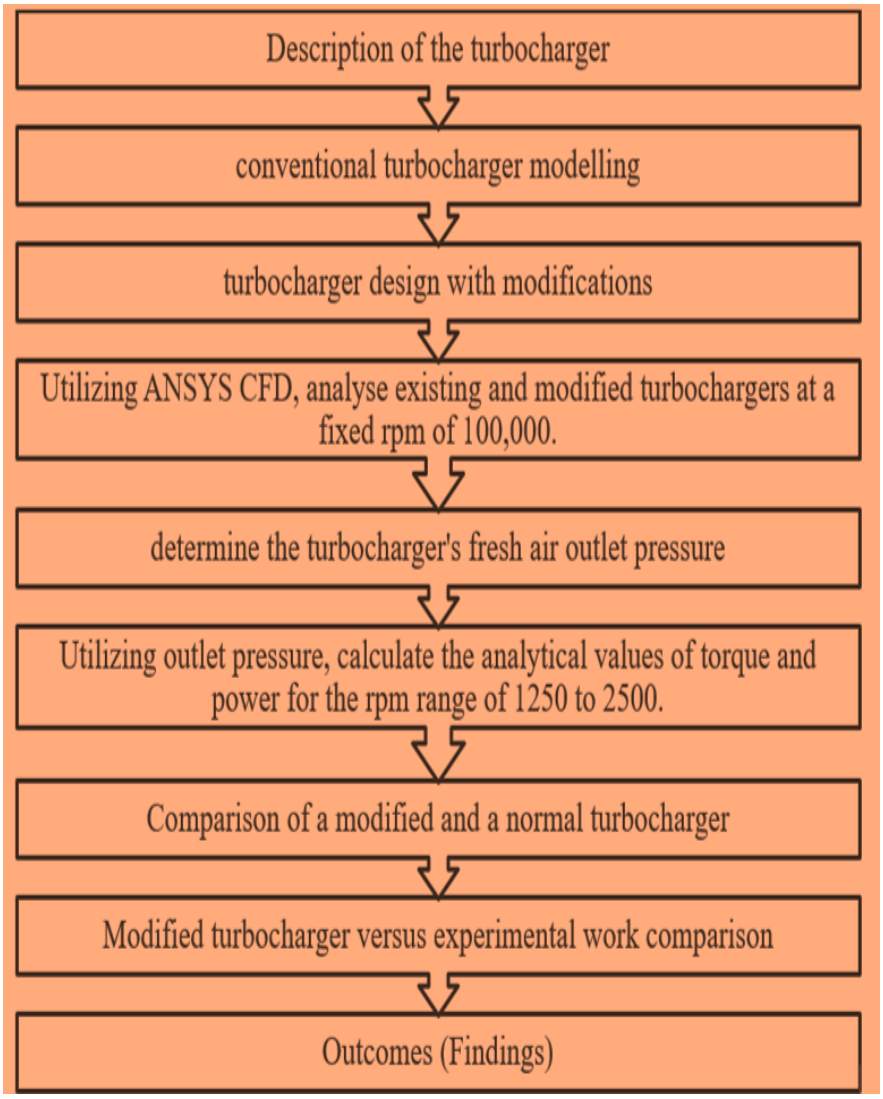
OBJECTIVES

The main objectives in this research work are

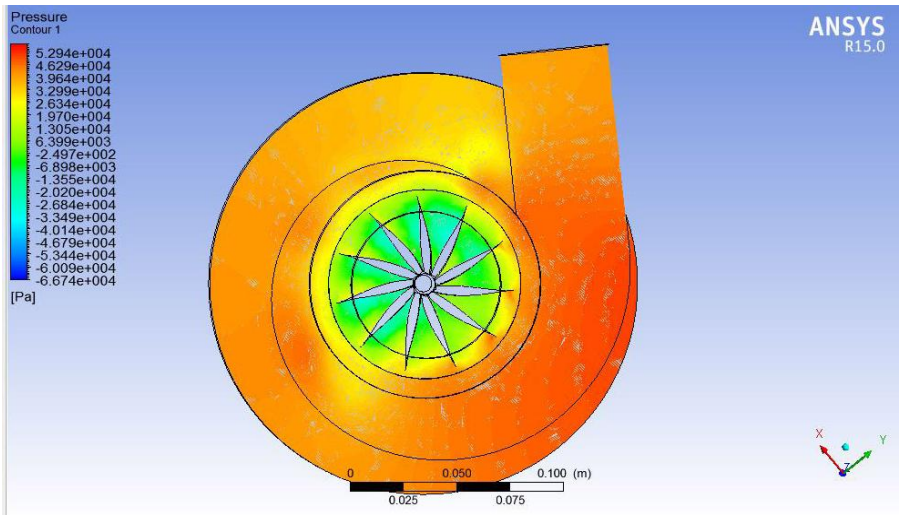
- Changing the compressor from a single impeller to a dual impeller to raise the engine's inlet pressure
- Power Gain at Different Engine RPMs
- An increase in torque at maximum power and various engine RPM
- Downsizing the engine
- Modification of the turbine to lower the turbine's exhaust gas inlet velocity.

METHODOLOGY

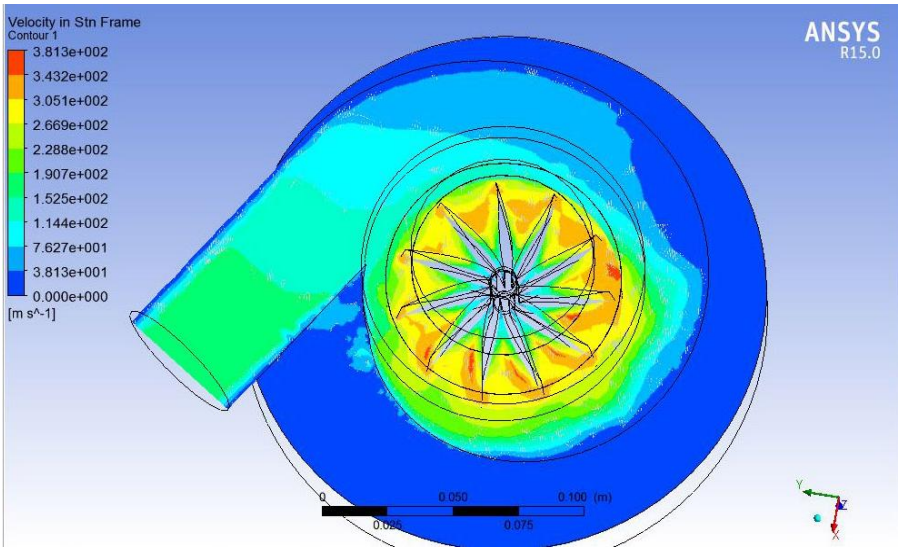
To increase the value of the mean pressure created by the turbocharger in this study, numerous procedures must be taken. The torque with power can be increased and engine downsizing is also achievable with this rise in the pressure value.



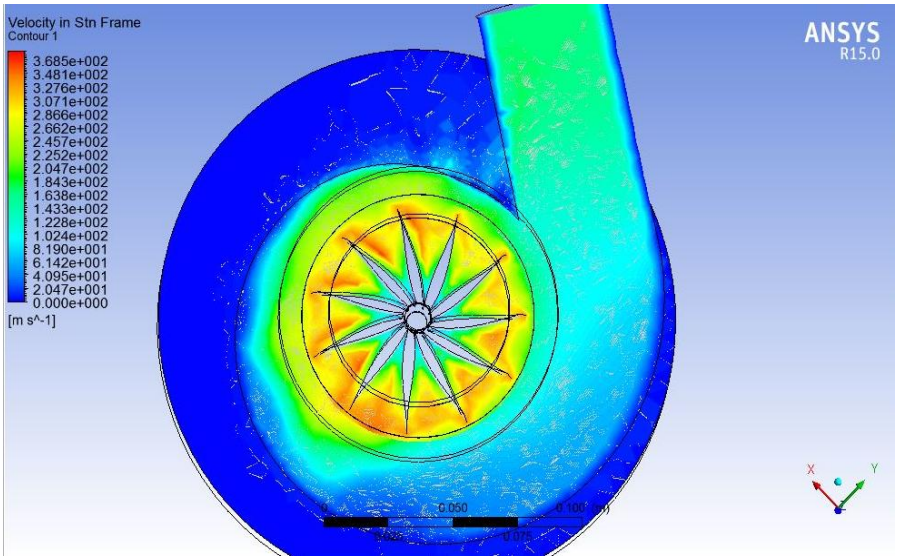
CFDANALYSIS



CFD analysis of pressure of exhaust gases in axial flow turbine

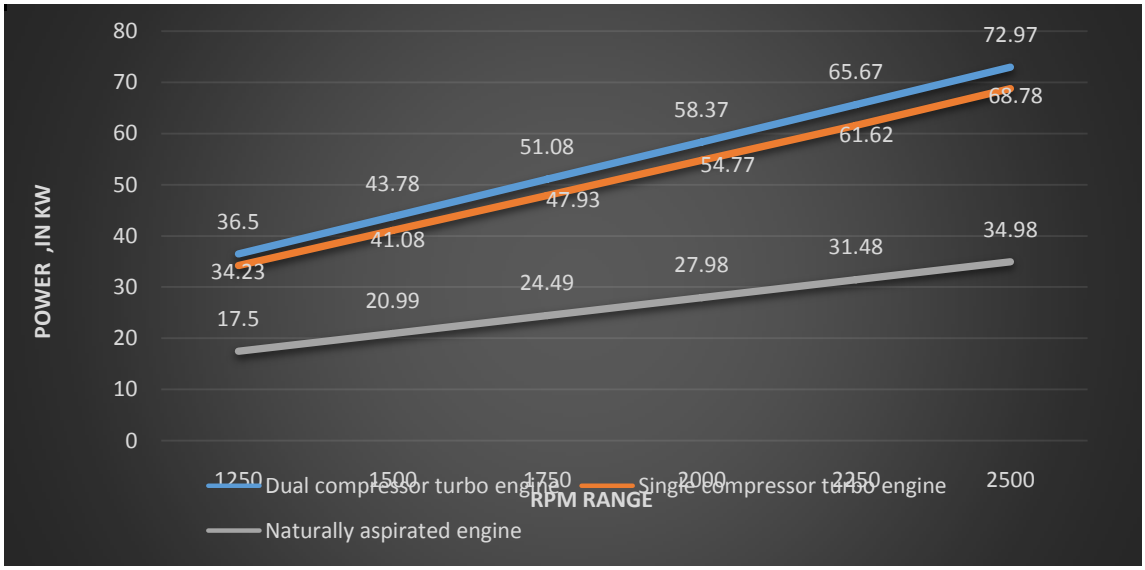


CFD analysis of velocity of exhaust gases atentryin axial flow turbine

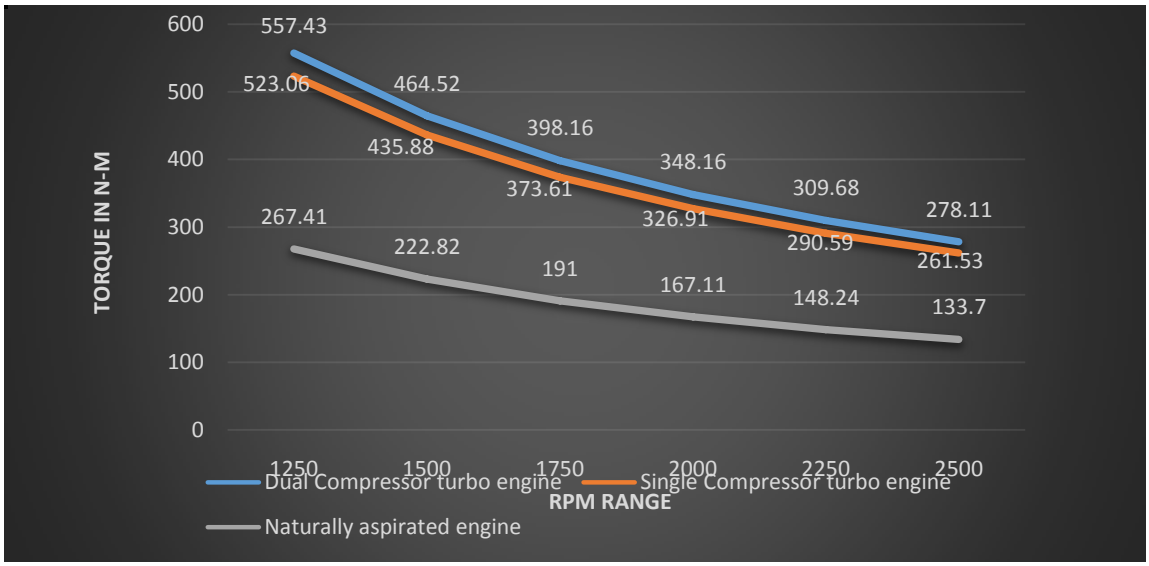


CFD analysis of velocity of exhaust gases atentryin axial flow turbine

RESULT ANALYSIS



power of different models at different rpm



Engine torque of different models at different rpm

CONCLUSION

- This analysis demonstrates that the pressure created inside the turbocharger that travels inside the engine during the suction stroke can be enhanced without the need of any other devices other than the turbocharger.
- With the use of this study, an existing engine's power can be increased without changing its volume or undergoing any other modifications.
- With only an impeller and compressor casing modification, the power can be increased by up to 7%.
- Modifying the impeller compressor can also enhance torque since, at a given rpm, dual impeller compressors produce greater torque than single impeller conventional compressors.

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