UPC - BARCELONA TECH
Master Numerical Methods in Engineering
Communication skills I | Fall 2016 | Assignment # 1

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Waste Heat Recovery Systems

Nowadays, the majority of industrial applications involve the implementation of thermal systems which usually produce waste heat as a result of the related heat transfer processes (e.g. the rejected heat from an internal combustion engine). On the other hand, the environmental regulations applied to industry are becoming more restrictive over the years. These two facts have led to the development of a group of technologies which could recover that waste energy and allow its reuse. These systems are called Waste Heat Recovery Systems (WHRS).

Currently, a thermal efficiency of an internal combustion engine (ICE) higher than 40 % is almost unreachable. This basically means that a large quantity of the combustible energy is not converted into useful work and it is rejected from the engine to the surroundings as waste heat. The recovery of this energy would be tremendously beneficial as it would allow to not only increase the engine power output and reduce combustible consumption, but also to further reduce harmful emissions [1].

Most of these recovery systems are applied to the exhaust manifold, since it is the main source of waste heat on ICE's. One of this recovery systems is the Organic Rankine cycle, which uses the waste heat to increase the temperature of a working fluid and obtain extra useful work upon the fluid expansion on a turbine. Another example is a thermoelectric generator which converts waste heat from a certain source into electrical energy by means of the Seebeck effect. Finally, one of the newest and more promising systems is the electrical turbocharger which includes a generator and a storage device [2].

Although thermoelectric generators are still a ongoing research topic, Organic Rankine cycles are widely used in cargo-ships giving up to a 2 % saving in the fuel consumption and up to a 5 % improvement in the engine efficiency [3]. In the case of electrical turbochargers, they are implemented in race cars, such as F1 cars. In the next assignment, we could go deep into the study of these recovery systems, by explaining the thermal processes they involve as well as the components which need to be incorporated to the engine in order to obtain an efficient functioning.

References

[1] Fu, J., Liu, J., Ren, C., Yang, Y., and Zhu, G., *A new approach for exhaust energy recovery of internal combustion engine.* Applied Thermal Engineering 2013;52:150 - 159

[2] Aeristech. Electronic source [on-line]: *http://www.aeristech.co.uk/full-electric-turbocharger-technology/*

[3] Man, Marine Engines and Systems. Electronic source [on-line] : *http://marine.man.eu/applications/container*