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[1]Lacour Stephanie*, [1]Descloux Sylvain, [1]Baldi Franscesco
[2]Delacroix Alain, [2]Podevin Pierre

[1] Laboratoire du génie des procédés pour l'environnement, l'énergie et la santé (LGP2ES-EA21), CEMAGREF, 1 Rue Pierre-Gilles de Genne, CS 10030, 92761 Antony cedex – France, email : stephanie.lacour@cemagref.fr
[2] Laboratoire du génie des procédés pour l'environnement, l'énergie et la santé (LGP2ES-EA21), Cnam, case 2D3R20, 292 rue saint Martin 75003 Paris - France

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ABSTRACT
Waste heat recovery (WHR) systems are an interesting way to improve the efficiency of internal combustion engines and reduce their fuel consumption for a given mechanical output. Exergy analysis is used to quantify the maximum amount of mechanical energy that could be recovered in the exhaust gases, i.e. the potential for recovery. In this paper, measurements are carried on a diesel tractor engine in order to assess this potential. We also measured the energy transferred in a secondary fluid through a heat exchanger placed in the tailpipe. First, a "steady state" map of exhaust gas exergy is computed for various operating conditions. It shows the great interest of waste heat recovery systems for tractor engine, because the highest potentials are observed for high load factors, the most frequent operating conditions. Then, we developed driving cycles in order to simulate an intermittent power demand similar to real use. The instantaneous exhaust exergy is always related to the instantaneous fuel exergy with a small delay. For cycles with constant engine speed, the exhaust gas exergy is, in average, proportional to the mechanical output work and to fuel exergy. But the thermal inertia influences the exhaust exergy, leading to a better recovering ratio when the power demand decreases and heat is desorbed. Moreover, measurements point out that the WHR potential is reduced during acceleration phases. Exhaust gas exergy grows slowly during acceleration because of the combined effects of lower temperature and air flow growths in this step. During deceleration, the recovery potential is therefore higher than in acceleration. The average potential in time is not sensitive to signal period and power range, but it is reduced of 20-30% when compared to a steady state assessment. In the secondary fluid circuit, a linear relation is observed between the exhaust gases exergy and the heat transferred to the cold fluid. Differences between acceleration and deceleration also appears leading to 10% more in the heat transfer during deceleration step.