World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

In-Cylinder Exhaust Heat Recovery of an I. C. Engine Using Water Injection

Authors : Jayakrishnan U.

Abstract : A concept of adding two strokes to a four stroke Otto or Diesel engine cycle presented here for the waste heat recovery in a four stroke internal combustion engine. Four stroke Diesel cycle and Otto cycle engines have very low thermal efficiency due to high amount of energy loss in exhaust and also on the cooling of the engine. It is estimated about 35 percent of fuel energy is lost in exhaust of engine and 30 percent in cooling of engine. So by modifying a four-stroke Otto or Diesel engine by adding two-stroke heat recovery steam cycle is presented here. Water injection is used to get an additional power stroke by partial compression of the exhaust gases at the end of third stroke in a four stroke I.C.Engine. It is the conversion of a four-stroke cycle to a six-stroke cycle. By taking a four stroke petrol engine of known dimensions, an ideal thermodynamic model is used to analyse and calculate the events of exhaust gas compression and following two strokes of water injection. By changing the exhaust valve closing timing during exhaust stroke and analysing it on various points, an optimum amount of exhaust gas re-compression and amount of water injection can be found for maximizing efficiency and fuel economy. It is achieved by changing the exhaust valve timing and finding an optimum amount of exhaust re-compression, maximizing the net mean effective pressure of the steam expansion stroke (MEPsteam). Specific fuel consumption of the engine also decreases increasing the fuel economy. The valve closing timings for maximum MEPsteam is limited by either 1 bar or dew point temperature of expansion gas or moisture mixture to avoid moisture formation. By modifying the four-stroke Otto or Diesel cycle by adding two water injection stroke has the potential to significantly increase the engine efficiency and fuel economy.

Keywords : internal combustion engine, engine efficiency, six-stroke cycle, water injection, specific fuel consumption
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020