

Recent Progress in Wave Rotor Combustion

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Abstract : With current concerns regarding global warming, demand for a society with greater environmental awareness significantly increases. With gradual development in hybrid and electric vehicles and the availability of renewable energy resources, increasing efficiency in fossil fuel and combustion engines seems a faster solution toward sustainability and reducing greenhouse gas emissions. This paper aims to provide a comprehensive review of recent progress in wave rotor combustor, one of the combustion concepts with considerable potential to improve power output and emission standards. A wave rotor is an oscillatory flow device that uses the unsteady gas dynamic concept to transfer energy by generating pressure waves. From a thermodynamic point of view, unlike conventional positive-displacement piston engines which follow the Brayton cycle, wave rotors offer higher cycle efficiency due to pressure gain during the combustion process based on the Humphrey cycle. First, the paper covers all recent and ongoing computational and experimental studies around the world with a quick look at the milestones in the history of wave rotor development. Second, the main similarity and differences in the ignition system of the wave rotor with piston engines are considered. Also, the comparison is made with another pressure gain device, rotating detonation engines. Next, the main challenges and research needs for wave rotor combustor commercialization are discussed.

Keywords : wave rotor combustor, unsteady gas dynamic, pre-chamber jet ignition, pressure gain combustion, constant-volume combustion

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