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Astral-type mechanisms on combustion performance and decrease of exhaust gases

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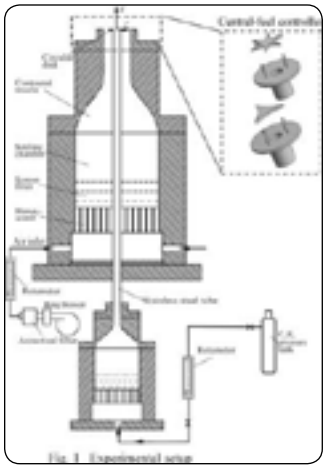
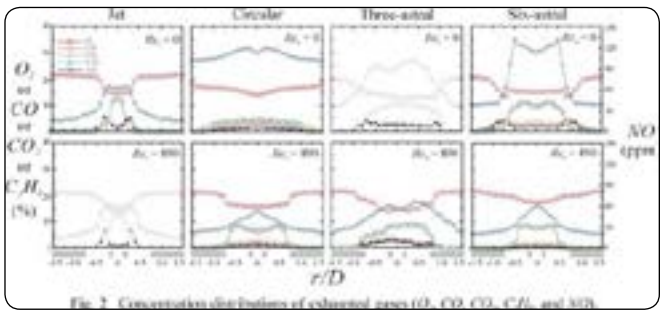
In this study, astral-type bluff bodies were placed on a burner to control flow fields, enhance the combustion efficiency of the burner and achieve energy conservation. In the experiment, the astral-type bluff bodies were placed on a burner when fluids passed the bluff bodies. The axial kinetic energy of the flow field was transformed into radial kinetic energy. The radial motion created a vortex flow structure that increased heat release and improved combustion efficiency. Furthermore, the astral-type mechanism was utilized to improve the mixing between fuel and air, and then reduce the formation of hydrocarbon. The experimental methods such as thermocouples and photography techniques were used to obtain the characteristic flame patterns, flame heights, temperature distribution, heat release rate, and the concentration of combusted exhaust gases. In this study, four bluff bodies (disk-shaped, concentric, three astral- type, and six astral-type) were utilized. The flame fields were divided into the following modes: jet flame, flickering flame, swirling flame, and lifted flame. The six- astral-type bluff body increased heat release by 44%, 35% increase by the concentric bluff body and 12.4% increase by the three astral-type bluff body. A gas analyzer was used to measure the concentration of exhaust gases (O_2, CO_2, C_3H_8, CO and NO) in the burner region. In comparison to that of a concentric bluff body, a 23% lower carbon monoxide (CO) concentration was generated when a six astral-type bluff body was used, whereas 40% CO was generated for a three astral-type bluff body.





Recent Publications:

1. Yen S C, Huang J X and San KC (2017) Wind farm characteristics of side-by-side and tandem configurations. Ocean Engineering. 137(1):89-98.
2. Yen S C, Shih C L and San K C (2017) Non-premixed flame characteristics and exhaust gas concentrations behind rifled bluff- body cones. Journal of the Energy Institute. 91(4):489-501.
3. Yen S C, Wu C H and San K C (2017) Characteristics of flow configurations around side-by-side twin wind blades. Experimental Thermal and Fluid Science. 82:302-313.
4. Yen S C, Wu S F and San K C (2016) Modulation of wake flow and aerodynamic behaviors around a square cylinder using an upstream control bar. Experimental Thermal and Fluid Science. 70:139-147.
5. Yen S C, Huang Y Z and San K C (2015) Thermal characteristics and exhaust-gas analysis behind bluff-body frustums. Fuel. 159:519-529.

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Biography

Shun Chang Yen, PhD received his BS Degree from Republic of China Air Force Academy, Taiwan in 1992 and MS and PhD in Mechanical Engineering from National Taiwan University of Science and Technology, Taiwan in 1998 and 2003 respectively. He is a Full Professor of Mechanical and Mechatronic Engineering Department at the National Taiwan Ocean University, Taiwan. His researches cover fluid mechanics, aerodynamics, combustion technology, chemically reacting flows and related fields.

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