Recent Research Progress on Rotating Detonation and Its Application in Different Engines

Bing Wang*, Haocheng Wen, Qiaofeng Xie
School of Aerospace Engineering, Tsinghua University, Beijing China, 100084
*Email: wbing@tsinghua.edu.cn, Tel. & Fax. +8610-62782154

Abstract:
Propulsion devices based on rotating detonation have been proposed, and hot tests have been performed over the past 60 years. With a historical overview of research highlights, this presentation focuses on recent research progress on unstable combustor phenomena, the combustion mode identification and the associated physical mechanism. Research indicates that multiple factors can influence rotating detonation instability and most of them can be linked to the reactants injection condition and combustor geometry. A series of instabilities can be identified in the combustor by either changing the mass flow rates and the equivalence ratios, or adopting a different injection configuration. The mechanisms for the effects of injection conditions are investigated by means of flow visualization and flame diagnosis. With respect to the effects of the combustor geometry, the minimum combustor channel has been accepted as a key criterion for the stable rotating detonation, but other geometrical factors have also been suggested to influence the instabilities, such as, the length of combustor, the hollow combustor and the exit size of throat. Both experimental and numerical simulations have been carried out in our laboratory investigating this problem. In particular, we experimentally investigated the mechanisms and the control method of the instabilities of rotating detonation, and an explanation based on the combustor acoustic modes has been proposed to illustrate the occurrence of unstable phenomena. Future prospects for rotating detonation engines are provided.