Advanced sensing combustion dynamics and combustion-generated acoustic noise

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Abstract

Making combustion systems more stable and quieter continues to be important practical problems. This is particularly so for industrial gas turbines, where greater combustion stability enables operation under ever-tightening emissions regulation, and for aircraft engines, where urban noise pollution limits aircraft operation. The literature on these problems has grown enormously, and now spans numerous applications including rockets, aircraft engines, gas turbines and industrial burners. Methods to reduce the combustion noise from aircraft engines are often attempted late in the design process, once almost all of the detailed engine design has been completed. Similarly, premixed combustors in industrial gas turbines have been known to be stable when operated in a test facility, but unstable when integrated into the full gas turbine on site; adjustments are then made to achieve stability.

This paper presents an experimental study of interaction between combustion dynamics and combustion-generated acoustic noise. The heat release response of combustion is investigated for a wide range of experimental conditions. Variations of sound pressure and CH* chemiluminescence signal are compared at several combinations of equivalence ratio and mixture velocity. The mechanism of sound generation in premixed combustion has been investigated by analysing the light emission from combustion. The results show reasonable agreement between the two sound pressures, even with the limitations in the sound pressure measurements. The close resemblance between the measured and calculated sound pressure implies that the noise is generated by the flame surface fluctuation.

Keywords: *Premixed combustion, Thermo-acoustics, Combustion dynamics*

References

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Biography

Dr. Seong-Ho Jin is a Vice President in KSEAUK and a Senior Lecturer in the School of Engineering at the University of Lincoln. He has extensive experience in the use of conventional and alternative fuels in automotive and gas turbine applications, including study of renewable energy sources. His research in these fields has mainly used laser-based diagnostic techniques. He has applied these techniques to the imaging of fluid flows, premixed and non-premixed flames, fuel sprays and combustion.