Editorial

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Advances by the Marie Curie project TANGO in thermoacoustics and aeroacoustics

This special issue features a selection of research papers produced by the project TANGO – an initial training network (ITN) with an international consortium of seven academic and five industrial partners. TANGO is the acronym for '**T**hermoacoustic and **A**eroacoustic **N**onlinearities in **G**reen combustors with **O**rifice structures'. During the four years of its lifetime (2012–2016), a total of 15 young researchers were funded by this network; the majority of them had three-year PhD positions. Further information about TANGO (such as the consortium members, research tasks and publications) can be found on the project website http://www.scm.keele.ac.uk/Tango/

As the title of the project suggests, thermoacoustics and aeroacoustics were the main areas of scientific enquiry. These disciplines are fundamental for the understanding of thermoacoustic instabilities. The basic mechanism driving a thermoacoustic instability is a three-way interaction between the heat release from a heat source (typically a flame), the acoustic field in the cavity that houses the heat source, and aerodynamic structures (such as vortices shed from an orifice and then impinging on the flame). This basic mechanism occurs in tandem with other physical and chemical processes, leading to a complex web of interactions, most of which are nonlinear. Research to unravel this web has been going on intensively for decades, but there are still a lot of open questions.

For environmental reasons, it is important to make combustors 'green', i.e. to develop combustion systems that have low levels of pollutant emission. This is achieved by lean premixed combustion. Unfortunately, this form of combustion is particularly prone to thermoacoustic instabilities. They manifest themselves by intense pressure oscillations, excessive structural vibrations, fatigue and even catastrophic damage to combustor hardware. Until thermoacoustic instabilities are fully understood, they are an obstacle for the development of green combustion systems.

The aim of TANGO was to develop a large amount of new understanding so as to predict under what conditions such instabilities occur, what amplitudes are reached, and – most importantly – how the instabilities can be prevented. The research was interdisciplinary and involved numerical, analytical and experimental approaches. It can be roughly divided into two parts: thermoacoustics and aeroacoustics, although there was considerable interaction across this divide. Two review papers, one focussing on thermoacoustics and the other one on aeroacoustics, will appear in a forthcoming issue of this journal.

The papers in this issue have undergone a rigorous review process. They give highlights of TANGO's research activities on a range of topics, including

- nonlinear analytical flame models,
- response of a swirl flame to inertial waves,
- intrinsic thermoacoustic modes,
- transition to thermoacoustic instability,
- nonlinear interaction between thermoacoustic modes,
- passive control by a heat exchanger,
- stochastic error of acoustic scattering matrices.

I hope very much that these papers will inspire other researchers to perform further studies into the intriguing topic of thermoacoustic instabilities. I also hope that some of the discoveries presented in this special issue will find applications in the design of cleaner combustion systems.

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