14:51–203A+B

### Experimental investigation of hypersonic boundary layer instability and transition by wavelet transform

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The instability of hypersonic boundary layer on a sharp cone is investigated in a hypersonic wind tunnel. The time signals of fluctuating surface-thermal-flux are measured by Pt-thin-film thermocouple temperature sensors mounted at 28 stations on the cone surface along the streamwise direction to investigate the development of the unstable disturbances. Wavelet transform is employed to obtain the multi-scale characteristics of fluctuation both in temporal and spectrum space. Wavelet-based cross-spectrum technique is introduced to obtain the multi-scale cross-spectral characteristics of the hypersonic fluctuating signals. The conditional sampling algorithm is put forward to extract the unstable disturbance from the fluctuating signals. The generic waveform for the unstable disturbance is obtained by phase-averaging technique. The development of the unstable disturbance along the streamwise direction is assessed both in the temporal and spectrum space.The bicoherence spectrum analysis based on wavelet coefficients is used to investigate the nonlinear interactions of the instability of Mack modes.

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14:54–203A+B

### Time correlations in compressible isotropic turbulence

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Time correlations of fluctuations in velocity, dilatation and pressure are calculated using direct numerical simulation of compressible isotropic turbulence. It is observed that the correlations decay with oscillations, which attributes to the wave propagation from the dilatational part. A model is proposed for time correlation. It combines the classical sweeping hypothesis and the wave propagation model. The former assumes that turbulent structures are convected mainly by energy-containing eddies, while the latter assumes that dilatation fluctuations play a role of wave propagation without source. This model is found to fit well with the time correlations. All curves of time correlations collapse into single one when rescaling the separation using the present model.

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14:57–203A+B

### Representative flow structure behind an Ahmed vehicle model

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The lasting high fuel price highlights the urgency of understanding thoroughly flow around vehicles for drag reduction. Ahmed model is a benchmark simplified car model for the study of the vehicle wake. Despite of previous investigations, the knowledge of flow around this model remains incomplete. This work aims to gain a relatively thorough understanding of the flow. A 1/3-scaled Ahmed vehicle model was used. The Reynolds number is $5.26 \times 10^4$, based on the model height and incident flow velocity. Extensive particle image velocimetry measurements were carried out in three orthogonal planes in the wake of the model placed in a wind tunnel. Two rear slant angles, i.e., $\alpha = 25°$ and $35°$, were examined, representing two distinct flow regimes. A number of findings have been made based on both instantaneous and time-averaged PIV data, resulting in modified flow structure models in representative flow regimes, as per classical models.

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## FS01: Acoustics
**16:10–18:10, Tuesday, 21 August**
**Weiqiu Chen, China, Chair**
**Victor Kopiev, Russia, Chair**
**Room: 203A+B**

16:10–203A+B

### Wave motion and resonances in damaged periodically layered composites

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This paper presents a time-harmonic analysis of plane elastic wave propagation in periodically layered composites with a single crack or periodically/randomly distributed cracks, which are located either in the interior of a layer or on the interface between two neighboring layers. The total wave field is written as a sum of the incident wave field and the scattered wave field described by an integral equation approach. A combination of the transfer matrix method and the boundary integral equation method is applied to obtain the wave transmission coefficients, from which the band-gaps can be obtained. In addition, a spring model is developed to approximate the damaged layer with a distribution of collinear cracks. Numerical examples will be presented and discussed for both a single crack or a distribution of cracks in the periodically layered composites. Special attention of the analysis is devoted to