# ON PRESSURE MEASUREMENTS IN CONTINUOUS-DETONATION COMBUSTORS

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**Abstract:** A computational study of the amplitude-frequency characteristics and time-averaged parameters of the signal supplied to a static pressure sensor and a sensor of pressure pulsations installed in the waveguide tube for remote recording of the parameters of the operation process in a continuous-detonation annular combustor is performed. The situation is simulated when a continuous-detonation operation process occurs in the combustor with local pressure pulsations at a frequency of 1000 or 500 Hz, caused by the arrival of a detonation wave continuously rotating in the annular gap. The influence of the volume of the receiver at the end of the waveguide tube and the frequency of pressure pulsations in the combustor on the readings of the pressure sensors is analyzed. It is shown that the remote placement of static pressure sensors at the ends of the waveguide tubes allows the time-averaged static pressure in the combustor to be recorded with an accuracy of $\sim$ 10%. The rotation frequency of detonation waves can be reliably measured by sensors of pressure pulsations installed at the lateral wall of the waveguide tube.

**Keywords:** continuous-detonation combustor; pressure pulsations; remote pressure sensor; amplitude-frequency characteristics of a signal; time-averaged pressure

**DOI:** 10.30826/CE20130106

## Figure Captions

**Figure 1** Schematic of pressure measurement in a PDE/RDE combustor with the remote sensors of pressure pulsations and/or static pressure sensors mounted in the waveguide tube and at its end

**Figure 2** Schematic of the experiment [5]

**Figure 3** Pressure histories measured by sensors PS1 and PS2 (*a*) and predicted pressure histories by Euler (*b*), Navier–Stokes (*c*), and Reynolds equations (*d*)

**Figure 4** Schematic of pressure measurement in RDE combustor with the remote sensors of pressure pulsations and/or static pressure sensors mounted in the waveguide tube and at its end

**Figure 5** Examples of predicted time histories of static pressure (*a*) and static temperature (*b*) at the inlet of the waveguide tube; $f_{\rm in} = 1000$ Hz

**Figure 6** Calculated time histories of mean static pressure $\bar{P}_r$ (*a*) and local instantaneous pressure $P_l$ in the waveguide tube – small receiver system (*b*); $f_{\rm in} = 1000$ Hz; $P_0 = 0.1$ MPa; and $V = 1$ cm$^3$

**Figure 7** Fourier transform of $\bar{P}_r(t)$ (*a*) and $P_l(t)$ curves (*b*) for the waveguide tube – small receiver system; $f_{\rm in} = 1000$ Hz; $P_0 = 0.1$ MPa; and $V = 1$ cm$^3$

**Figure 8** Calculated time histories of mean static pressure $\bar{P}_r$ (*a*) and local instantaneous pressure $P_l$ (*b*) in the waveguide tube – large receiver system; $f_{\rm in} = 1000$ Hz; $P_0 = 0.1$ MPa; and $V = 125$ cm$^3$

**Figure 9** Fourier transform of $\bar{P}_r(t)$ (*a*) and $P_l(t)$ (*b*) curves for the waveguide tube – large receiver system; $f_{\rm in} = 500$ Hz; $P_0 = 0.1$ MPa; and $V = 125$ cm$^3$

**Figure 10** Fourier transform of $\bar{P}_r(t)$ curve for the waveguide tube – small receiver system ($f_{\rm in} = 500$ Hz and $P_0 = 0.1$ MPa): (*a*) $V = 1$ cm$^3$; and (*b*) $V = 125$ cm$^3$

## Acknowledgments

This work was supported by the subsidy given to the N. N. Semenov Federal Research Center for Chemical Physics of the Russian Academy of Sciences to implement the state assignment on the topic No. 0082-2016-0011 (Registration No. AAAA-A17-117040610346-5).

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*Received November 11, 2019*

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