ON ONE POSSIBILITY OF THE DETERMINATION OF WIND SPEED AND DIRECTION

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ABSTRACT

Lately methods of remote observations of atmospheric parameters by means of lasers have been developing intensively. In the earlier versions of laser velocimeters turbulent flow velocity was determined by measuring a carrier wave doppler shift and direction of turbulent flows by azimuth and elevation scanning. In this case errors in the determination of wind speed and direction can reach significant values because of a wide Doppler spectrum and momentary instability of laser.

The determination of a turbulent flow velocity vector based on correlation characteristics measurements of laser signals scattered by atmospheric aerosols allows to increase the accuracy of the determination of wind speed and direction considerably. The essence of the correlation method consists in measuring delay time between two signals received from different directions. The accuracy of wind speed measurements depends significantly on the repetition rate of sounding pulses. Pulse repetition rate characteristics of the pulsed lasers designed by the present time prevent them from being used for a correlation meter. That is why a CW laser with a high-frequency modulator was chosen for this purpose as a generator. As far as CW lasers are characterized by relatively low output power, an optical heterodyne receiver scheme was designed in order to increase the potential of the correlation meter. In this case owing to a heterodyne signal power increase, it is possible to improve a signal-to-noise ratio in comparison with direct detection. Besides, a heterodyne receiver makes it possible to operate in a balance mode which leads to a significant improvement of a signal-to-noise ratio and increases the correlation meter potential in general.