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论文

基于光闪烁法的烟气流速反演和路径加权函数的分析

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摘要:

为了对工业管道排放的污染气体的流速进行连续监测,设计了一种双路平行对射式烟气流速测量系统,并对基于光闪烁法测量烟气流速的相关理论进行了研究.利用相位屏技术对湍流介质中的光闪烁现象进行了理论分析,得到了用于工业管道烟气流速反演的光闪烁互相关的表达式.对烟气流速反演过程中平均流速的路径加权问题进行了探讨,给出了路径加权函数,数值模拟表明路径加权函数具有近似高斯线型的轴对称分布特性,反映出管道中心流速对于平均流速的较大贡献.在此基础上,分析了光源光谱对路径权重函数的影响,实验证明由于光源光谱具有一定的带宽,使得路径加权函数值有一定的变化,但加权函数的分布形状保持不变.对于平均流速的路径加权函数的分析为计算工业管道中烟气流速的空间分布提供了依据.

关键词: 相位屏 光闪烁 流速 路径加权函数

Calculation of Stack Gas Flow Velocity Based on Optical Scintillation and Analysis of Path-weighting Function

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Abstract:

To monitor the velocity of industrial exhaust gas continuously, a parallel double-path flow velocity measurement system was designed, and the related theories on measuring the velocity of stack gas flow was studied based on the light scintillation. A simple phase-screen technique was used to analyze the light scintillation in a turbulent medium, and the expression of optical scintillation cross-correlation was obtained which is used to measure stack gas flow velocity. The path-weighting function of the mean velocity was given. The numerical simulation carried on path-weighting function indicates that it has axially symmetric distribution as Gaussian line shape, and the central velocity of the stack makes greater contribution. The impact of light source spectrum on path-weighting in principle was analyzed, and the preliminary experiments show that, although because the light source spectrum has a certain bandwidth, the path-weighting function has changed, the distribution is still axially symmetric. Based on the path-weighting function, the space distribution of the gas flow velocity in stack can be calculated.

Keywords: Phase-screen Optical scintillation Flow velocity Path-weighting function

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