Journal of Engineering and Applied Sciences 13 (8): 1963-1967, 2018
ISSN: 1816-949X

Calculation of Friction Resistance of End Plates Affecting Flat Jet Fading

G. Toleuov, M. Isataev, Sh. Ospanova, Zh. Seydulla, A. Nurmukhanova, D. Babasheva,
A. Musatayev, T. Akhanserina, G. Paizolla, G. Musabayeva, S. Ermaganbetova,
A. Nurseytova, M. Nurmagambetov and D. Tamabek
Scientific Research Institute of Experimental and Theoretical Physics,
Al-Farabi Kazakh National University, Almaty, Kazakhstan

Abstract: This research shows results of calculation of friction resistance of end plates affecting tendencies of free flat jet behavior. Flow diagram of jet flowing among end surfaces is built up. Estimate of friction at turbulent boundary layer is fulfilled. Calculation formula for the first study which describes variation of maximum jet velocity at a first approximation is acquired. These calculation data are compared with the experimental data. Also, a theoretical calculation of the second study was conducted. For this study calculation formula about the maximum velocity variation was received.

Key words: Plates, affecting, flow diagram, calculation formula, experimental data, theoretical, calculation

INTRODUCTION

During recent decades dynamic and pulsation characteristics of free three-dimensional jet flowing out of the nozzle with rectangular outlet section within the major and partially the initial sections of friction have been studied in details (Abramovich *et al*., 1984; Quinn, 1992; Faghani *et al*., 2010). During recent time also vortex structure has been studied and its effect on development of turbulent and averaged flow parameters within the initial, transitional and major sections of free jet stream have been focused. At studying flat jet in experimental plants as a rule in order to exclude interference of finiteness of rectangular nozzle height the flow field is confined by end plates installed in parallel with the flow direction as continuation of end walls of outlet section of the rectangular nozzle. Here as we can see by virtue of influence of end walls, we have a flat jet confined by these side walls instead of three dimensional jet. We might as well say that new obtained experimental and theoretical data provide wide information on effect of end walls and large scale coherent vortexes on development of turbulent jets flowing out of the rectangular nozzle. For instance in the research (Isataev *et al*., 2015) friction resistance of end plates affecting tendencies of free flat jet behavior is studied by experiments. During recent time coherent flow structures of walls jets are also under focus of attention (Namgyal and Hall, 2013). This investigation area is an important subject for studies. Also, it's important to carry on studies of dynamic flow parameters. This research study described as continuation of experimental studies shown in the research study (Isataev *et al*., 2015) contains theoretical calculation of friction resistance of end plates affecting tendencies of free flat jet behavior.

CALCULATION OF RESISTANCE INFLUENCE ALONG END WALLS

To build up calculation of resistance influence of end walls on flat jet fading let's consider the following diagram of jet flowing among end surfaces. Figure 1 shows diagrams of a jet stream confined by flat end walls in planes xoy and xoz. In the plane xoy, the jet just as in the ordinary free jet has initial section (index "I"), transitional section (index "t") and major section as well as side free shifting borders, the nozzle width along the axis oy equals 2b. In the plane xoz, the jet flowing out of the nozzle with height 2 h on sides along the axis oz is confined by end plates. Within the first section of the jet after leaving the nozzle along the end walls laminar or turbulent boundary layers are developing with homogenous profile along the axis z between the limits boundary layers. Development of boundary layers is analogical to the boundary layer typical for homogeneous flow flowing along the plate. At the end of the 1st section boundary layers join on the jet axis and the 2nd jet section begins in which in the plane oz the flow is analogical to current flow in a flat channel. Accordingly development of the boundary layer and the current within the 1st section are analogical to homogeneous flow flowing along the plate within the 2nd section-analogical to current flow in a flat channel.

Corresponding Author: G. Toleuov, Scientific Research Institute of Experimental and Theoretical Physics,
Al-Farabi Kazakh National University, Almaty, Kazakhstan