SPATIAL LINEAR FLOWS OF FINITE LENGTH WITH NONUNIFORM INTENSITY DISTRIBUTION

Irrotational flows produced by spatial linear flows of finite length with different uneven lows of discharge over the flow length are represented in cylindrical coordinate system. Flows with the length 2a are placed in infinite space filled with ideal (inviscid) fluid. In “A” variant discharge is fading linearly downward along the length of the flow. In “B” variant in upper half of the flow (length a) discharge is fading linearly downward, in lower half of the flow discharge is fading linearly from the middle point to lower end. In “C” variant discharge of the flow is growing linearly from upper and lower ends to middle point.

Equations for discharge distribution along the length of the flow are provided for each variant. Equations consist of two terms and include two dimensional parameters and current coordinate that allows integrating on flow length. Analytical expressions are derived for speed potential functions and flow speed components for flow speeds produced by analyzed flows. These analytical expressions consist of dimensional parameters and discharge distribution patterns along the length of the flow. Flow lines equation (meridional sections of flow surfaces) for variants “A”, “B”, “C” is unsolvable in quadratures. Flow lines plotting is proposed to be made by finite difference method. Equations for flow line plotting are provided for each variant. Calculations of these equations show that the analyzed flows have the following flow lines: “A” has confocal hyperbolical curves, “B” and “C” have confocal hyperboles. Flow surfaces are confocal hyperboloids produced by rotation of these hyperboles about the axis passing through the flows. In “A” variant the space filled with fluid is separated by vividly horizontal flow surface in two parts. In upper part that includes the smaller part of the flow length flow lines are oriented downward, in lower part – upward. The equation defining coordinate of intersection of this flow surface and flow is also provided. In “B” and “C” variants confocal horizontal flow surface passes through the center of the flow and its discharge is divided in this point in two equal parts. Calculation of flow discharge dependence of discharge of fluid between the two flow surfaces is provided for each variant. These equations allow calculating fluid discharge between the two flow surfaces for known flow discharge and vice versa calculating flow discharge for known discharge between the two flow surfaces. The analyzed flows meet the conditions of flow potentiality and continuity.

Key words: linear flow, intensity distribution, speed potential, flow line, kinematic characteristics.

References

About the author: Mikhaylov Ivan Evgrafovich — Doctor of Technical Sciences, Professor, Department of Hydraulics and Water Resources, Moscow State University of Civil Engineering (MGSU), 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; orexov_gv@mail.ru.