# THE PROBLEM OF BRACHYSTOCHRONE IN A CLOSED CHANNEL WITH INCOMPRESSIBLE NEWTONIAN FLUID

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The velocity of fluid drainage in closed channels is of importance in several areas of knowledge due to its inherently economic gravity. In some situations, in the chemical industry, in civil engineering and in nuclear power plants, the rapid disposal of the stored product is necessary. In some situations, pressurizers are used. However, it is not always possible to guarantee that these pressurizers are operative all the time. In this work, we carry out an analytical-numerical study of the flow of non-Newtonian fluids under the action of gravity in closed channels with a circular cross section of radius $R$ in order to find the curve that presents the highest flow between two points with a height difference $h$ and horizontally separated by a distance $w$. The initial configuration is three curves (straight, cycloid and orthogonal junction) through which a fluid flows under conditions of non-slip walls, constant gravity and zero pressure at the lowest point. Via numerical solution of the Navier-Stokes equations and continuity in the steady state we computed the hydraulic permeabilities of the channels through Darcy's Law in the flow in which viscous forces dominate. We generate a new curve with the points and $y$-coordinate of the previous curves being calculated through the average weighted by the hydraulic permeability of the cited curves. We calculate the permeability of the new curve and compute the next curve excluding the contribution of the lowest permeability curve in the initial configuration. This procedure is repeated until the new generated curve does not present a significant difference with the last curve via convergence criterion in the difference of the coordinate-$y$. When considering the domain regime of viscous forces, with constant density and viscosity, we were able to show the dependence of the shape of the curve generated on the channel radius. It is expected to find a different dependency when considering the transition to regimes in which inertia forces exert influence.