

The goal of this work is to find a solution to the problem of incompressible fluid flow in the pipe induced by a time periodic pressure gradient. Boundary conditions including a time derivative of velocity field are considered. This type of boundary conditions models a dynamic response of the fluid at the boundary and such behaviour can be used for example in molten polymers fluid modeling. First we look for a specific form of the solution using the Fourier method. The solution is decomposed into a linear combination of functions based on the Bessel function of zero order. We then study these functions in more details. Then we investigate the convergence of sequence of approximative solutions in the space of continuous functions and in the Lebesgue space. In proofs we use the properties of the Bessel function and in particular we investigate the distribution of the roots of Bessel function. We also use a numerical software to compute an approximative solution based on the Fourier method.