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SOLVABILITY OF THE BOUNDARY VALUE PROBLEMS FOR CERTAIN SELF-SIMILAR EQUATIONS [1]

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Introducing the stream function in governing partial differential equations of mathematical models of various physical processes and choosing the self-similar variables frequently one obtains the boundary value problem for the self-similar ordinary differential equation or their system. As a rule these self-similar equations have quadratic non-linearity and depend on parameters. Wide range of investigations, among them qualitative investigations, during the century paid attention to such problems, initially from the classical works along the latest ones. It must be mentioned that the considering of non-Newtonian processes notably extends the area of exploration.

For example, using the boundary layer approximation for the investigations of laminar boundary layers on slender bodies of revolution in axial flow or free convection about a flat heated plate embedded in a porous medium, or etc. (see, [1]), we can obtain the boundary value problems on the half-axis for the equation

$$f'''' + a_1(\alpha) f f''' + a_2(\alpha) f' f'' = 0,$$

where a_1 and a_2 are rational functions of parameter α. This form of equation includes the classical Blasius and Falkner-Skan equations. As the equation has the fourth order the most artless boundary value problems in this case is the de la Vallee-Poussin problems. Equations of such type arising in hydrodynamics explored also in works of Latvian physicists (for example, [2], [3]).

Some existence and uniqueness results with respect to values of the parameter for the aforesaid self-similar problems will be considered.

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