Steady state non-Newtonian flow with strain rate dependent viscosity in thin tube structure with no slip boundary condition

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Thin tube structures are finite unions of thin cylinders depending on the small parameter, ratio of the diameter of the cross section to the length of the cylinder. Flows in such domains model blood flow in a network of vessels. The asymptotic expansion of the solution of the steady Stokes and Navier-Stokes equations in these domains with no slip boundary condition was constructed in the papers [1], [2] and the book [3]. However, the blood exhibits a non-Newtonian rheology, when the viscosity depends on the strain rate. In the present talk we consider such rheology. Applying the Banach fixed point theorem we prove the existence and uniqueness of a solution and its regularity. An asymptotic approximation is constructed and justified by an error estimate. The first and the second authors are supported by the European Social Fund (project No 09.3.3-LMT-K-712-01-0012) under grant agreement with the Research Council of Lithuania (LMTLT).

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