Flow of a viscous fluid past a flexible membrane at low Reynolds numbers

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The numerical calculation of a steady two-dimensional viscous flow past a flexible membrane is treated. Both edges of the membrane are fixed in the flow and its chord is set normal to the flow. The Navier–Stokes equation in terms of the stream function and the vorticity is transformed to the body fitted coordinate system. The numerical calculations, based on a finite difference method and relaxation method, are carried out for several values of the membranes tension for cases when the Reynolds numbers are 5, 10 and 20. It is found that two different shapes of the membranes are possible at a given value of tension and Reynolds number: one with a small deformation, and the other with a large deformation. Two vortices appear in the concave region of the membrane if its deformation increases beyond a certain extent.

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