Equilibrium rotation of a vortex bundle terminating on a lateral wall

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Probably, in the theory of quantum vortices the most significant result (apart from the discovery of the quantum vortices themselves) was the forming of the vortex lattice in the rotating helium. Paradoxically, but the question how this lattice appears is open up to now. Currently this process was thoroughly investigated in superfluid ^{3}He-B theoretically and experimentally in the Helsinki group. Vorticity is generated at the container bottom and propagates upward along the cylindric container axis in the form of a vortex bundle flaring to lateral container walls. The structure and dynamics of this flaring bundle, whether it is turbulent or laminar, what is the velocity of its propagation - that are questions, which need theoretical description. In the present work the trial, equilibrium states of the corresponding vortex structure are built and studied. These states possess the "own" angular velocity obtained from the standard conditions, that the thermodynamic potentials of system below an above the front are equal, and variation of the structure with respect to the shape is zero. If the container rotates with the same angular velocity neither dissipation nor propagation of the vortex front along the container axis is possible. If the angular velocities of the flaring vortex bundle and the container differ and there are dissipative mechanisms (interaction with the normal component and/or pinning on the lateral walls) then the front should propagate with the velocity evaluated on the basis weakly nonequilibrium theory.