Problem 5.33
This problem is from “Advanced Fluid Mechanics Problems” by A.H. Shapiro and A.A. Sonin.

At $t = 0$, a circular tank of radius $R$ contains water at rest, with a depth $h$. Between $0 < t < \tau$, a water hose is sprayed onto the surface of the water in the tank at a volume flow rate $Q$ and an exit velocity $V_j$. The jet impacts tangentially on the water at a radius $R_j$, with an angle $\theta$ relative to the horizontal.

After the time $\tau$, the hose is turned off. Eventually, because of friction within the water, all the water in tank will end up rotating like a solid body.

Derive an expression for the final angular rate of rotation $\Omega$ of the water, assuming shear forces between the water and the walls of the tank are negligible.
2.25 Advanced Fluid Mechanics
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