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Brachistochrone curve of a fluid filled cylinder SRIKANTH SARMA, SHARAN RAJA, PALLAB SINHA MAHAPATRA, Department of Mechanical Engineering, Indian Institute of Technology Madras, India, MAHESH PANCHANGNULA, Department of Applied Mechanics, Indian Institute of Technology Madras, India — The brachistochrone curve for a non-dissipative particle tries to maximize inertia of the particle but for a fluid filled cylinder, increasing inertia would amount to high dissipative losses. Hence the trade off between inertia and dissipation plays a vital role in the dynamics of a fluid filled cylinder. This trade off manifests itself in the form of an integro-differential equation governing the angular acceleration of the cylinder. Here, we compute the brachistochrone curve using optimal control principles and investigate the effect of the fore mentioned trade off on the deviation of the brachistochrone curve from that of a non-dissipative particle. Also, we investigate the effects of the non-dimensional parameters of the problem on the shape of the brachistochrone curve. We analyze the dissipation rate during the cylinder's motion and show that energy based arguments don't hold good for a fluid filled cylinder. We then analyze the stability of the time varying fluid flow in the cylinder and find an admissible region for the terminal point which would ensure the stability of the fluid flow as the cylinder rolls over the brachistochrone curve.

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