EE 231 first semester AY2021-2022 : Homework 01

1. In the coupled disks system below, disk 2 is placed on top of disk 1, with the bottom part of disk 2 making contact with the top surface of disk 1. The contact between disk 1 and disk 2 results in friction between the two surfaces. Assume that the coefficient of friction between the two surfaces is B.

Disk 1 and disk 2 have moments of inertia J_1 and J_2, respectively, about the center axis. Assume that the disk 1 and disk 2 are rotating about the vertical axis with angular velocities $\dot{\theta}_1$ and $\dot{\theta}_2$, respectively.

Write the differential equation model of the coupled disks system.

Note that there is no external torque applied to either disks. If it helps, you can imagine the system starting with disk 1 at some initial velocity $\dot{\theta}_1(0) \neq 0$ and disk 2 at rest (i.e., $\dot{\theta}_2(0) = 0$). Needless to say, disk 2 does not stay at rest as it starts rotating because of the friction between the two disks.