Sam Nesmith Dynamics Problem

Speed governor
From video: Two masses on either side. Pulled together by a spring. As spins faster, masses want to move outward, creating frictional force to slow system

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Problem statement: Sam wants to create a speed governor for a set of automatic retracting blinds. His current design consists of a stationary housing with radius 2 cm. The springs inside have a spring constant of 250 N/m and a resting length of 1.5 cm. On the end of each spring is a 30 gram mass. The masses have a sliding coefficient of friction $\mu_k = 0.35$against the inside housing walls.

a. What is the minimum rotational velocity of the center axis before the masses contact the housing walls?
b. Assume the blind retraction mechanism causes a constant angular acceleration of 20 rad/s^2 at the center axis. What is the maximum angular velocity of the center axis?
c. Given the angular acceleration in b, plot the maximum angular velocity as a function of
    i. Spring constant
    ii. Mass
    iii. Initial length of spring

    with all other variables constant.

    Do each of these plots make sense? What do they tell us about the maximum angular velocity? How might Sam use this data to inform his design decisions?