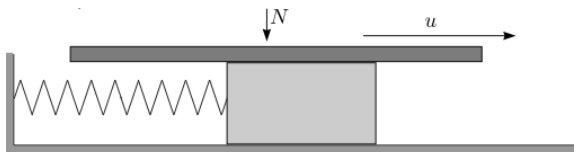
6. Violin string ***(9 points)*** The motion of a bow puts a violin string into a periodic motion. Let us make a simplified model of this process. The string has elasticity and inertia, so we substitute it by a block of mass m, fixed via a spring of stiffness k to a motionless wall and laying on a frictionless horizontal surface. The bow is substituted by a horizontal plate, which is pressed with constant force N downwards, and which moves with a constant velocity u, parallel to the axis of the spring, see Figure. The static coefficient of friction between the plate and the block is μ_1, and the kinetic coefficient of friction is $\mu_2 < \mu_1$. So, as long as the plate does not slide with respect to the block, the coefficient of friction equals to μ_1; as soon as there is some slip, it decreases down to μ_2.



i) (2 pts) For questions (i) and (ii), let us assume that the speed of the plate u is very small as compared to the maximal velocity of the block. What is the maximal velocity of the block $v_{\max}$ (maximized over time)?

ii) (2 pts) Sketch qualitatively the graph of the displacement of the block as a function of time and indicate on the graph the durations of the prominent stages of the block motion (graph segments).

iii) (1,5 pts) Now, let us abandon the assumption about the smallness of u. Sketch qualitatively the graph of the velocity of the block as a function of time.

iv) (2,5 pts) Determine the amplitude A of the block's oscillations.

v) (1 pt) Which condition (strong inequality, $\gg$ or $\ll$) must be satisfied for u in order to ensure that the oscillations will be almost harmonic?