Homework 6: Friction and Momentum

Due: Tuesday November 6th, 16:00

Policy: Collaboration is allowed, but every student is required to hand in his/her own version of the solutions. Please include your name and student number on the solutions.

Problem 1. We consider motion in a two-dimensional Cartesian coordinate system with orthonormal unit vectors $\hat{\boldsymbol{i}}$ and $\hat{\boldsymbol{j}}$. A point particle with mass $m_1 = 3$ kg has velocity 6 $\hat{\boldsymbol{j}}$ (m/s), while a second point particle with mass $m_2 = 2$ kg has speed 8 m/s, and its velocity makes an angle of $-30°$ with $\hat{\boldsymbol{i}}$. A third point particle has mass $m_3 = 5$ kg. Determine its velocity such that the velocity of the center of mass vanishes of the three particles together vanishes.

Problem 2. (K. & K., Ex. 4.6) A light plane with mass 450 kg makes a landing on a short runway. With its engine off, it lands on the runway at $v_0 = 140$ km/hour. A hook on the plane snags a cable attached to a 100 kg sandbag and drags the sandbag along. If the coefficient of friction μ between the sandbag and the runway is 0.4, and if the planes brakes give an additional retarding force of 300 N, how far does the plane go before it comes to a stop?