Issue: (FRI) 09/ 27/ 2024
Due: (FRI) 10/11/ 2024 18:00

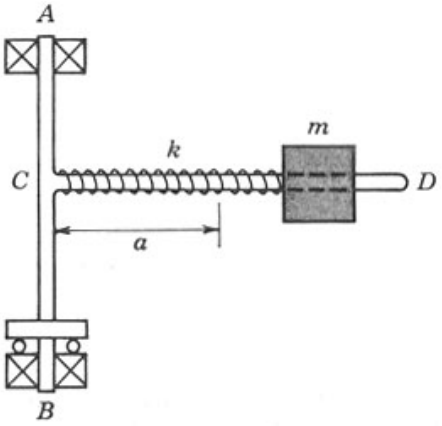
分析動力學作業 #1 Total 105 Points

Constraints, Principle of Virtual Work

遲交不予計分

Problem 1. (15 Pts) As shown in the following figure, a massless rigid shaft AB rotates in a frictionless bearing. A mass slides without friction on a rigid horizontal arm CD, and is restrained by a linear spring of unstrained length *a*.

(a) Select a complete set of independent generalized coordinates.
(b) How many degrees of freedom does this system have?
(c) Please select another set of generalized coordinates, which are complete but not independent. State the constraint equation.



Problem 2. (15 Pts) Consider a Pfaffian form constraint

$$(y^2 - 6xy)dx + (3xy - 6x^2)dy = 0 .$$

Please express this constraint in its configuration form.

Problem 3. (15 Pts) Two small masses, m_1 and m_2, are constrained to move in a vertical plane by two inextensible strings, as shown in the following figure. The lengths of the two strings are R and $L = \rho + r$, respectively. There is a force of magnitude F acting on the mass m_2, with its line of attack always parallel to the string attached to m_2. The constant of gravity is g. The pulley shown in the figure is small and frictionless. Please use the Cartesian coordinates of m_1 and m_2 as the generalized coordinates and determine the constraints and the degrees of freedom of this system. Please also show that this system is holonomic and scleronomic.

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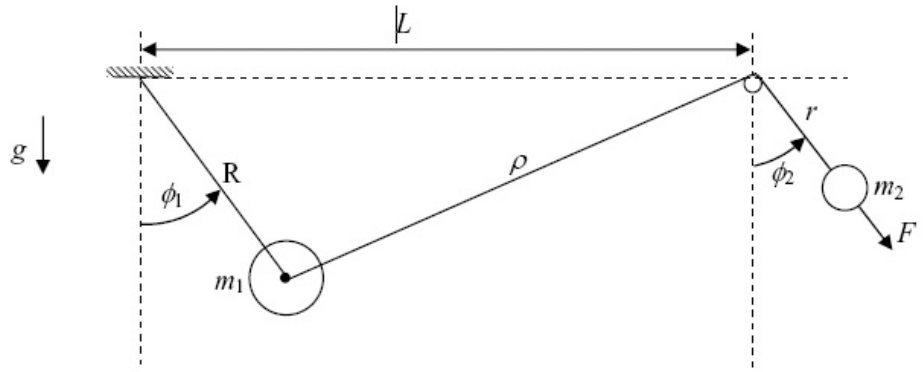
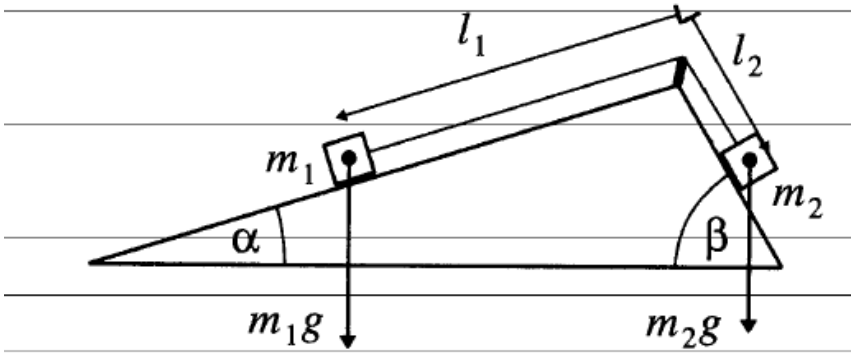


Problem 4. **(15 Pts)** *Greenwood* Problem 1.1

Problem 5. **(15 Pts)** *Greenwood* Problem 1.4

Problem 6. **(15 Pts)** In the setup of the following figure, two masses are connected by a rope move without friction. Please use d'Alembert principle to show the equation of motion as

$$\ddot{l}_1 = \frac{m_1 \sin\alpha - m_2 \sin\beta}{m_1 + m_2} g$$



Problem 7. (15 Pts) *Greenwood* Problem 1.6