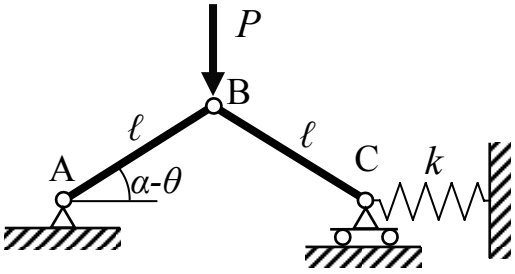
MEK 4530 – Autumn 2006: Extra practice problems 1

1. (a) Solve the two problems that are presented in Section 2.2.2 of Bergan and Syvertsen by writing expressions for the total potential energy and considering their stationary values.

   (b) Obtain corresponding results for the case when the rod is vertical in the unloaded condition and there is no horizontal load F, but the vertical force P is applied with an eccentricity (offset) e relative to the axis of the rod.

2. The figure shows two rigid bars, AB and BC, each of length ℓ, which are pivoted (hinged) together at B. Bar AB is pivoted to a rigid support at A. End C of bar BC is at the same vertical height as A and is pivoted to a carriage that can move without friction on a horizontal surface. The carriage is restrained by a horizontal, linear elastic spring of stiffness k as shown. The initial angle between AB and the horizontal is α. When a vertical load P is applied at B as shown, this angle is reduced to $(\alpha - \theta)$.

   Write an expression for the total potential energy of the system, and obtain a relation between $P/k\ell$ and θ for static equilibrium. Sketch this relationship within the range $0° \le \theta \le 70°$ for the case of $\alpha = 30°$, and investigate the stability of the equilibrium states in this range.



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