RO2102: Dynamics and Simulation

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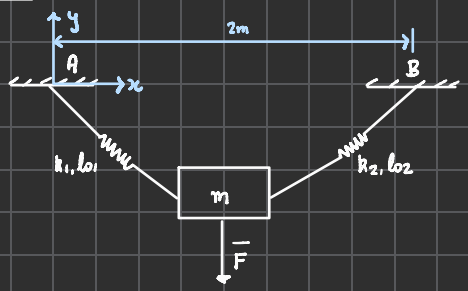
Homework-1

Problem 1 **Due:** 16-Jan-2025 **Time Spent:** 2.5 Hours

Sketch:



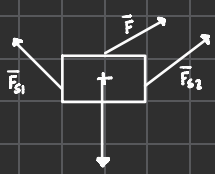
Given: $k_1 = 10N/m$; $k_2 = 20N/m$; $m = 5kg$; $r(0) = [1 \ -2]'m$; $\bar{r}_{BA} = [2 \ 0]'m$

$l_{01} = 1m$; $l_{02} = 1.414m$; $g = 10ms^{-2}$; $v(0) = [0 \ 0]'ms^{-1}$; $\bar{F} = [5 \ 1]'N$

To Find: $r(t)$

Apply LMB,

FBD: Mass



$$\Sigma \bar{F}_i = m\bar{a}$$

$$\Rightarrow \boxed{\bar{F} + \bar{F}_{s1} + \bar{F}_{s2} - mg\hat{j} = m\bar{a}}$$

$$\bar{F}_{s1} = k_1 (|\bar{r}_{A/m}| - l_{01}) \frac{(\bar{r}_{A/m})}{|\bar{r}_{A/m}|} = -k_1 (|\bar{r}(t)| - l_{01}) \frac{\bar{r}(t)}{|\bar{r}(t)|}$$

$$\bar{F}_{s2} = k_2 (|\bar{r}_{B/m}| - l_{02}) \frac{(\bar{r}_{B/m})}{|\bar{r}_{B/m}|} = -k_2 (|\bar{r}(t) + \bar{r}_{A/B}| - l_{02}) \frac{(\bar{r}(t) + \bar{r}_{A/B})}{|\bar{r}(t) + \bar{r}_{A/B}|}$$