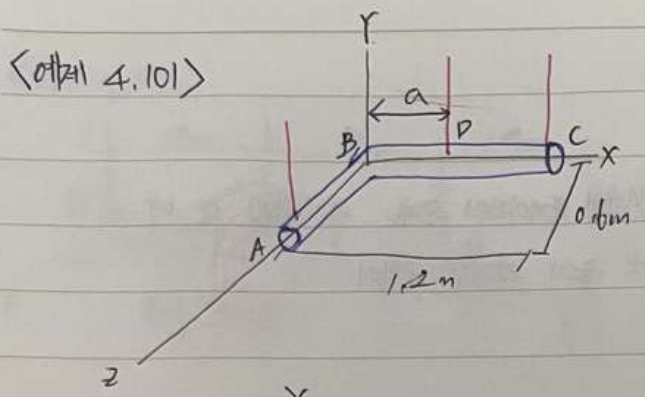
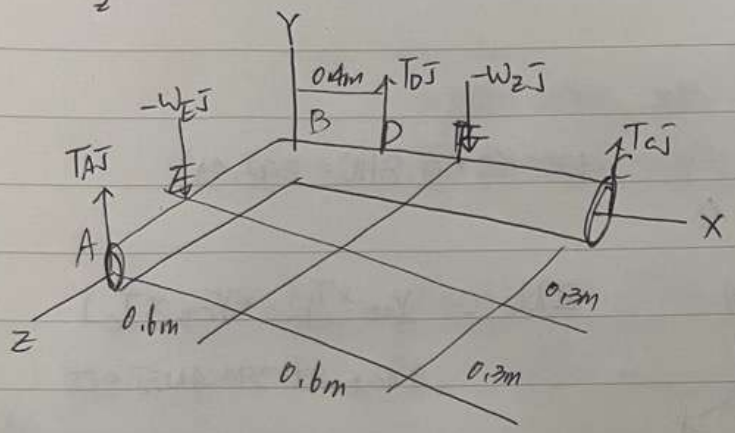
〈예제 4.101〉



단위 길이당 질량이 8kg/m인 파이프 AB, BC 부재가 용접되어 3개의 와이어로 지지.
a=0.4m 일 때, 각 와이어의 장력을 구하시오.



$W_1 = 0.6m'g$

$W_2 = 1.2m'g$

$\Sigma M_D = 0 : r_{A/D} \times T_A\bar{j} + r_{E/D} \times (-W_1\bar{j}) + r_{F/D} \times (-W_2\bar{j}) + r_{C/D} \times T_C\bar{j} = 0$

$(-0.4\bar{i} + 0.6\bar{k}) \times T_A\bar{j} + (-0.4\bar{i} + 0.3\bar{k}) \times (-W_1\bar{j}) + 0.2\bar{i} \times (-W_2\bar{j}) + 0.8\bar{i} \times T_C\bar{j} = 0$

$-0.4T_A\bar{k} - 0.6T_A\bar{i} + 0.4W_1\bar{k} + 0.3W_1\bar{i} - 0.2W_2\bar{k} + 0.8T_C\bar{k} = 0$

$\bar{i} : -0.6T_A + 0.3W_1 = 0$, $T_A = \frac{1}{2}W_1 = \frac{1}{2}0.6m'g = 0.3m'g$

$\bar{k} : -0.4T_A + 0.4W_1 - 0.2W_2 + 0.8T_C = 0$

$-0.4(0.3m'g) + 0.4(0.6m'g) - 0.2(1.2m'g) + 0.8T_C = 0$

$T_C = \dfrac{(0.12 - 0.24 - 0.24)m'g}{0.8} = 0.15m'g$

$\Sigma F_y = 0 : T_A + T_C + T_B - W_1 - W_2 = 0$

$0.3m'g + 0.15m'g + T_D - 0.6m'g - 1.2m'g = 0$, $T_D = 1.35m'g$

$m'g = (8kg/m)(9.81m/s^2) = 78.480\ N/m$

$T_A = 0.3m'g = 0.3 \times 78.480 = \underline{23.5N}$

$T_C = 0.15m'g = 0.15 \times 78.480 = \underline{11.77N}$

$T_D = 1.35m'g = 1.35 \times 78.480 = \underline{105.9N}$