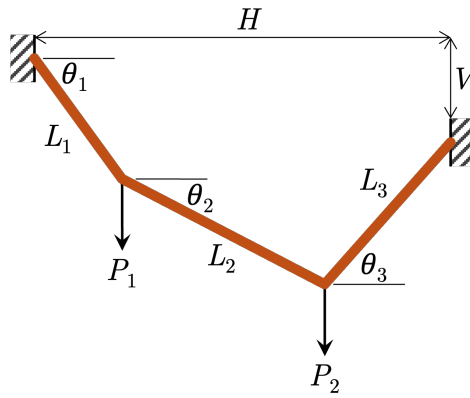


CVE154 Exam 3

prepared by Christian Cahig for classes of A.Y. 2024-2025 S1

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Referring to the following diagram, the $(L_1 + L_2 + L_3)$ -long cable carries concentrated loads P_1 and P_2 . H and V denote the horizontal and vertical clearances, respectively, between the left and right ends of the cable.



Derive a system of nonlinear equations through which the angles θ_1 , θ_2 , and θ_3 may be determined numerically via multidimensional Newton-Raphson. As such, provide the symbolic form of the Jacobian as a function of θ_1 , θ_2 , and θ_3 . Finally, compute (using `scipy.optimize.root()`) the said angles when $L_1 = 4$, $L_2 = 6$, $L_3 = 5$, $H = 12$, $V = 3$, $P_1 = 16$, and $P_2 = 20$. Lengths are in meters and forces are in kilonewtons.