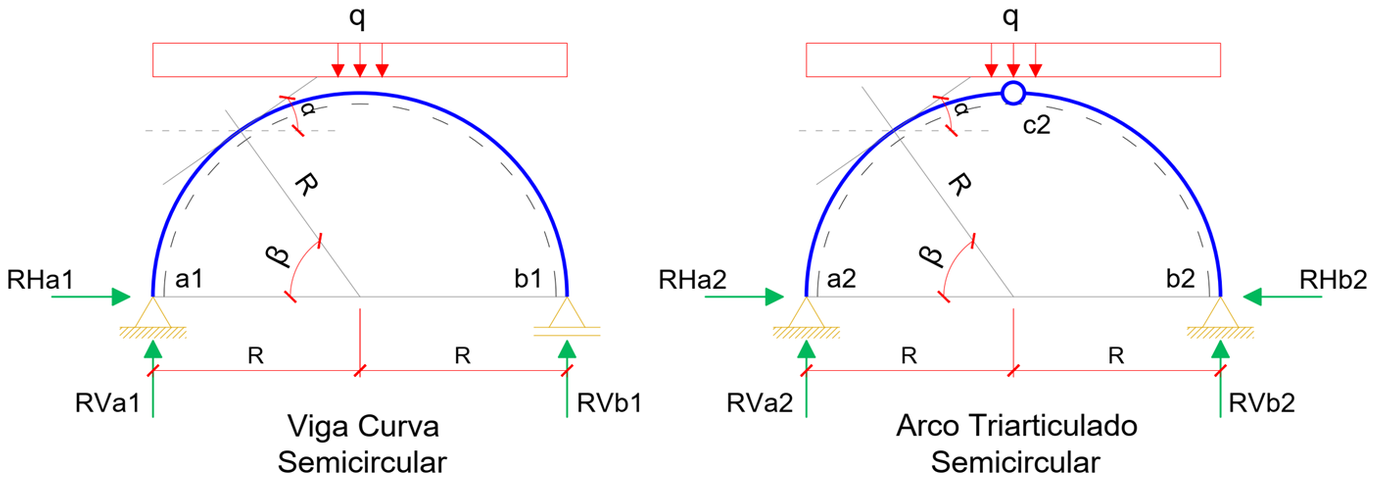
TE1_E07-09

Proceder os traçados dos diagramas de Momentos Fletores, Esforços Cortantes e Esforços Axiais para os dois modelos estruturais abaixo .

Dados comuns aos dois modelos: $q := 25\ \frac{kN}{m}$ $R := 4\ m$



Reações de Apoio:

Para a Viga Curva: ΣFh = 0 $RHa1 := 0$

ΣMa1 = 0 (+) anithorário $RVb1 \cdot 2 \cdot R - q \cdot 2 \cdot R \cdot R = 0$ $RVb1 := \frac{q \cdot 2 \cdot R \cdot R}{2 \cdot R} = 100\ kN$

ΣFv = 0 (+) para cima $RVa1 + RVb1 - q \cdot 2 \cdot R = 0$ $RVa1 := -RVb1 + q \cdot 2 \cdot R = 100\ kN$

Para o Arco: ΣMa2 = 0 (+) anithorário $RVb2 \cdot 2 \cdot R - q \cdot 2 \cdot R \cdot R = 0$ $RVb2 := \frac{q \cdot 2 \cdot R \cdot R}{2 \cdot R} = 100\ kN$

ΣFv = 0 (+) para cima $RVa2 + RVb2 - q \cdot 2 \cdot R = 0$ $RVa2 := -RVb2 + q \cdot 2 \cdot R = 100\ kN$

ΣMc2 = 0 (+) horário (olhando para "a2")

$RVa2 \cdot R - RHa2 \cdot R - q \cdot R \cdot \frac{R}{2} = 0$ $RHa2 := \frac{1}{R} \cdot \left(RVa2 \cdot R - q \cdot R \cdot \frac{R}{2} \right) = 50\ kN$

ΣFh = 0 (+) para direita

$RHa2 - RHb2 = 0$ $RHb2 := RHa2 = 50\ kN$

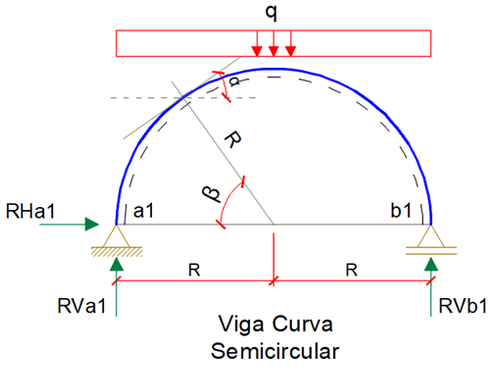
Equações de Momentos Fletores:

$x := R - R \cdot \cos(\beta)$ $y := R \cdot \sin(\beta)$

$M1h(\beta) := RVa1 \cdot x - \frac{q \cdot x^2}{2}$

$M1v(\beta) := -RHa1 \cdot y = 0$

$M1(\beta) := M1h(\beta) + M1v(\beta)$



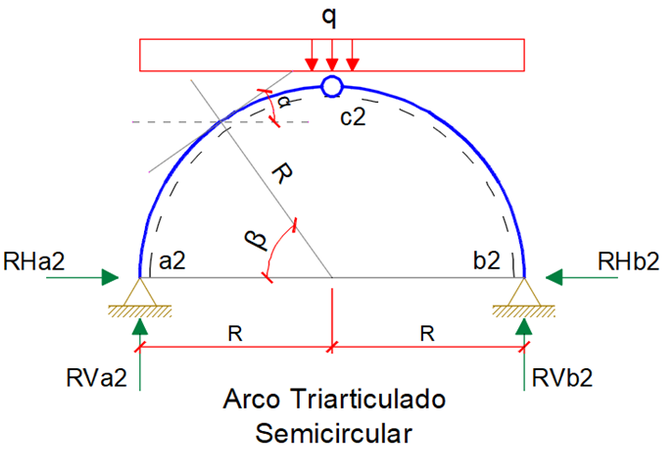
$M1_teste(\beta) := RVa1 \cdot (R - R \cdot \cos(\beta)) - \frac{q \cdot (R - R \cdot \cos(\beta))^2}{2} - RHa1 \cdot R \cdot \sin(\beta)$

$M1(90°) = 200\ kN\ m$ $M1_teste(90°) = 200\ kN\ m$

$M2h(\beta) := RVa2 \cdot x - \frac{q \cdot x^2}{2}$

$M2v(\beta) := -RHa2 \cdot y$

$M2(\beta) := M2h(\beta) + M2v(\beta)$

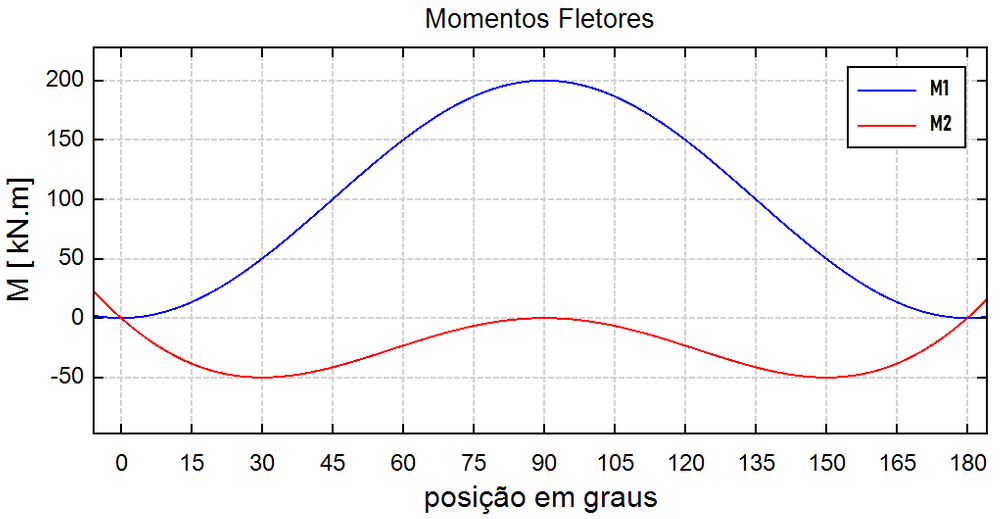


$M2_teste(\beta) := RVa2 \cdot (R - R \cdot \cos(\beta)) - \frac{q \cdot (R - R \cdot \cos(\beta))^2}{2} - RHa2 \cdot R \cdot \sin(\beta)$

$M2(90°) = 0$ $\qquad$ $M2_teste(90°) = 0$

$M2(30°) = -50\ kN\ m$ $\qquad$ $M2_teste(150°) = -50\ kN\ m$

$M2(135°) = -41,4214\ kN\ m$ $\qquad$ $M2_teste(135°) = -41,4214\ kN\ m$



Equações de Cortantes e Axiais:

$\alpha(\beta) := 90° - \beta$

$$V(\alpha) = \Sigma VER.\cos\alpha - \Sigma HOR.sen\alpha$$
$$N(\alpha) = -\Sigma VER.sen\alpha - \Sigma HOR.\cos\alpha$$

$x := R - R \cdot \cos(\beta)$ $\qquad$ $y := R \cdot \sin(\beta)$

$\Sigma VER1(x) := RVa1 - q \cdot x$

$\Sigma HOR1(y) := RHa1$

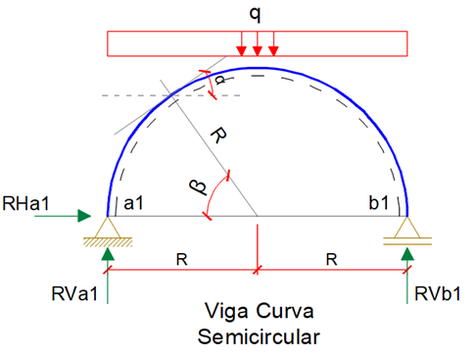
$V1(\beta) := \Sigma VER1(x) \cdot \cos(\alpha(\beta)) - \Sigma HOR1(y) \cdot \sin(\alpha(\beta))$

$N1(\beta) := -\Sigma VER1(x) \cdot \sin(\alpha(\beta)) - \Sigma HOR1(y) \cdot \cos(\alpha(\beta))$

$V1(0°) = 0$ $\qquad$ $N1(0°) = -100\ kN$

$V1(45°) = 50\ kN$ $\qquad$ $N1(45°) = -50\ kN$

$V1(90°) = 0\ kN$ $\qquad$ $N1(90°) = 0\ kN$



$\alpha(\beta) := 90\ ° - \beta$

$$V(\alpha) = \Sigma VER.\cos\alpha - \Sigma HOR.\mathrm{sen}\alpha$$
$$N(\alpha) = -\Sigma VER.\mathrm{sen}\alpha - \Sigma HOR.\cos\alpha$$

$x := R - R \cdot \cos(\beta)$ $\quad y := R \cdot \sin(\beta)$

$\Sigma VER2(x) := RVa2 - q \cdot x$

$\Sigma HOR2(y) := RHa2$

$V2(\beta) := \Sigma VER2(x) \cdot \cos(\alpha(\beta)) - \Sigma HOR2(y) \cdot \sin(\alpha(\beta))$

$N2(\beta) := -\Sigma VER2(x) \cdot \sin(\alpha(\beta)) - \Sigma HOR2(y) \cdot \cos(\alpha(\beta))$

