A curved rod with radius r resists a force $\vec{F}$. If the fixed connection at O can withstand a maximum moment magnitude of M_{max}, what is the largest magnitude F that can be applied before the connection breaks?

$$\vec{r}_{OA} = r(1 + \cos\theta)\,\widehat{i} + r\sin\theta\,\widehat{j}$$

$$\vec{F} = F(\cos\theta\,\widehat{i} + \sin\theta\,\widehat{j})$$

Assuming positive moments are counterclockwise:

$$M_O = r(1 + \cos\theta) \cdot F\sin\theta - r\sin\theta \cdot F\cos\theta$$
$$\Rightarrow M_O = r \cdot F\sin\theta$$

Since $M_O \leq M_{max}$,

$$r \cdot F\sin\theta \leq M_{max}$$
$$\Rightarrow F \leq \frac{M_{max}}{r\sin\theta}$$