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Microturbinas eólicas inspiradas en el vuelo de un albatros

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The Flight of Albatross—How to Transform It into Aerodynamic Engineering?

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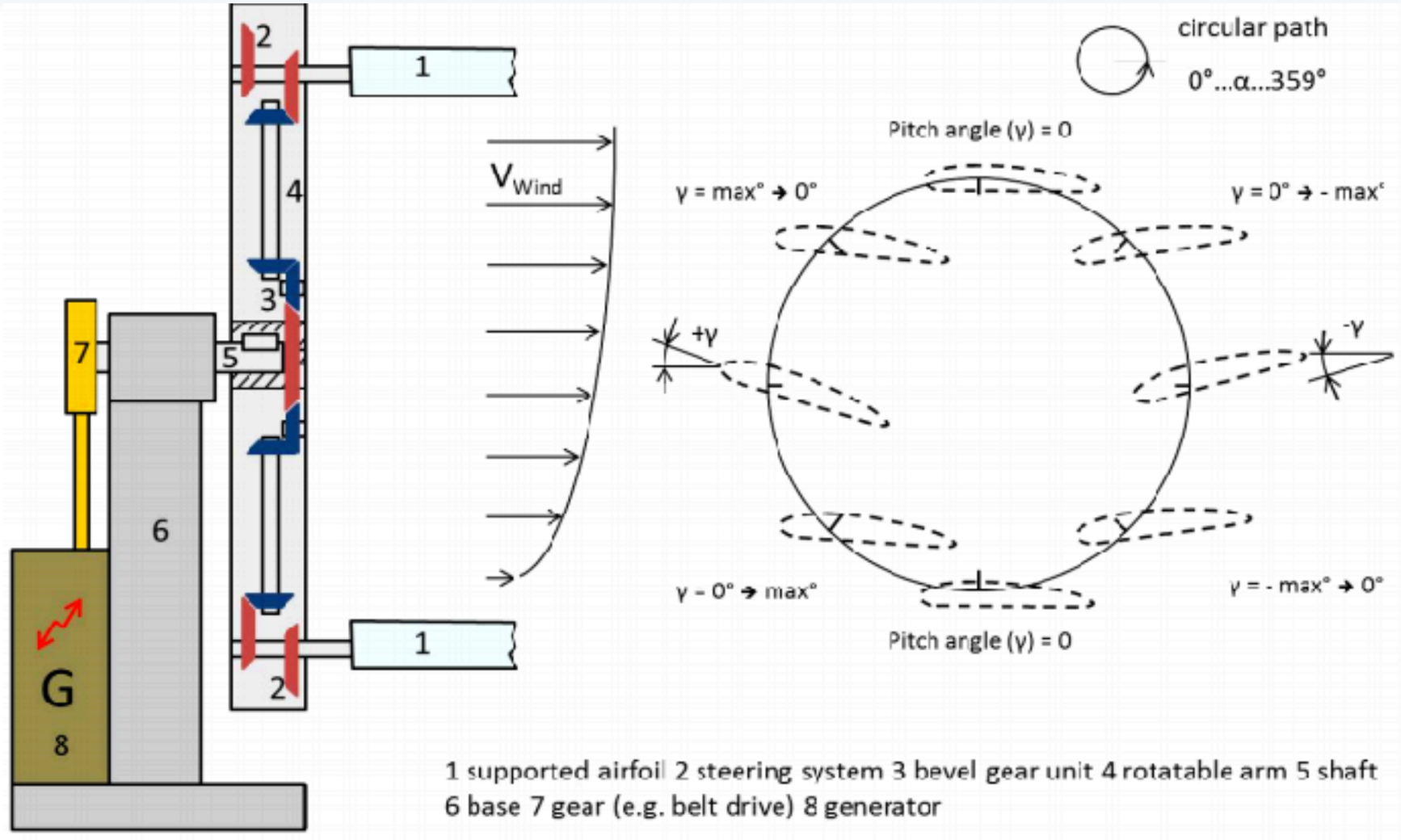
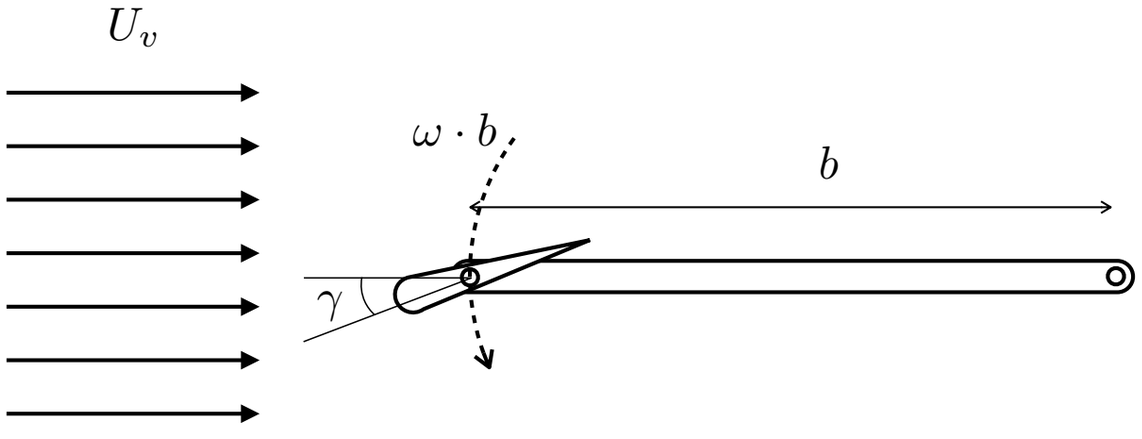
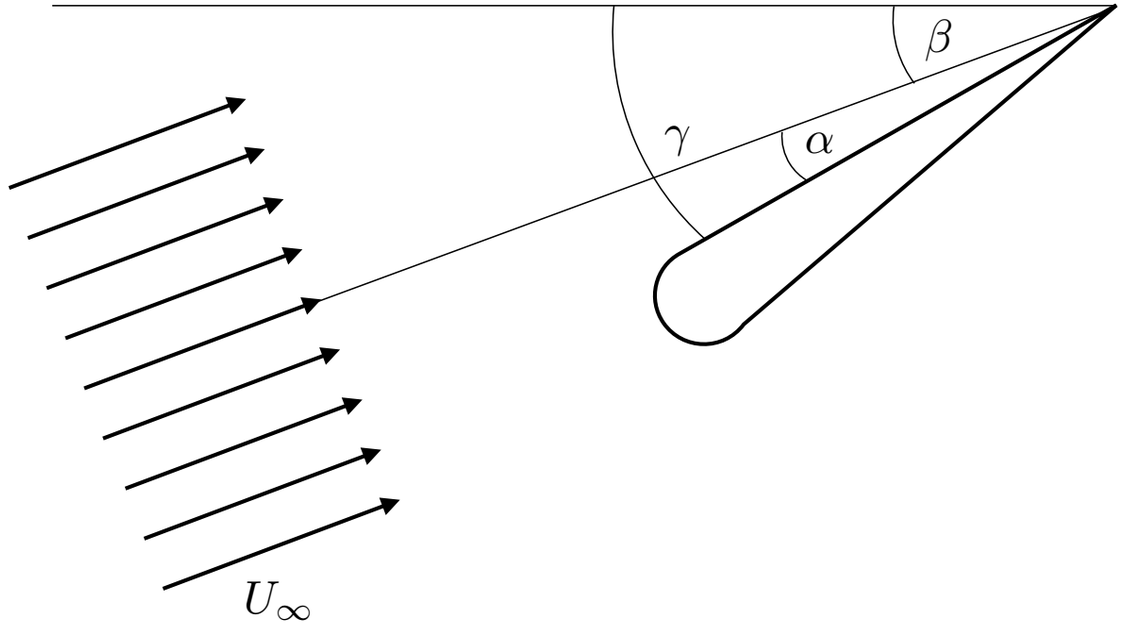


1 supported airfoil 2 steering system 3 bevel gear unit 4 rotatable arm 5 shaft
6 base 7 gear (e.g. belt drive) 8 generator





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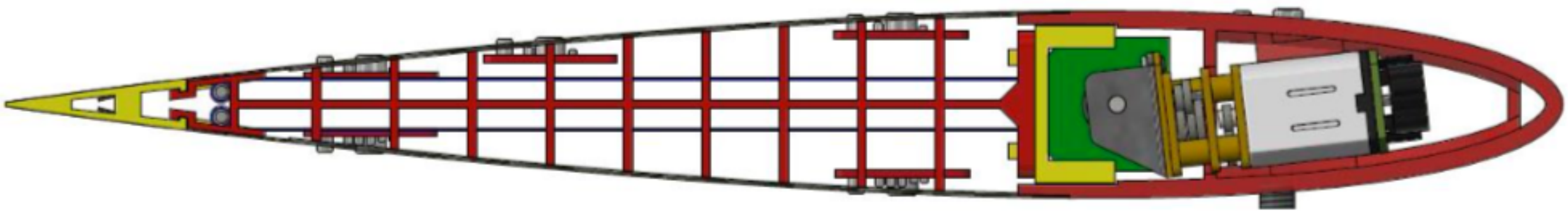
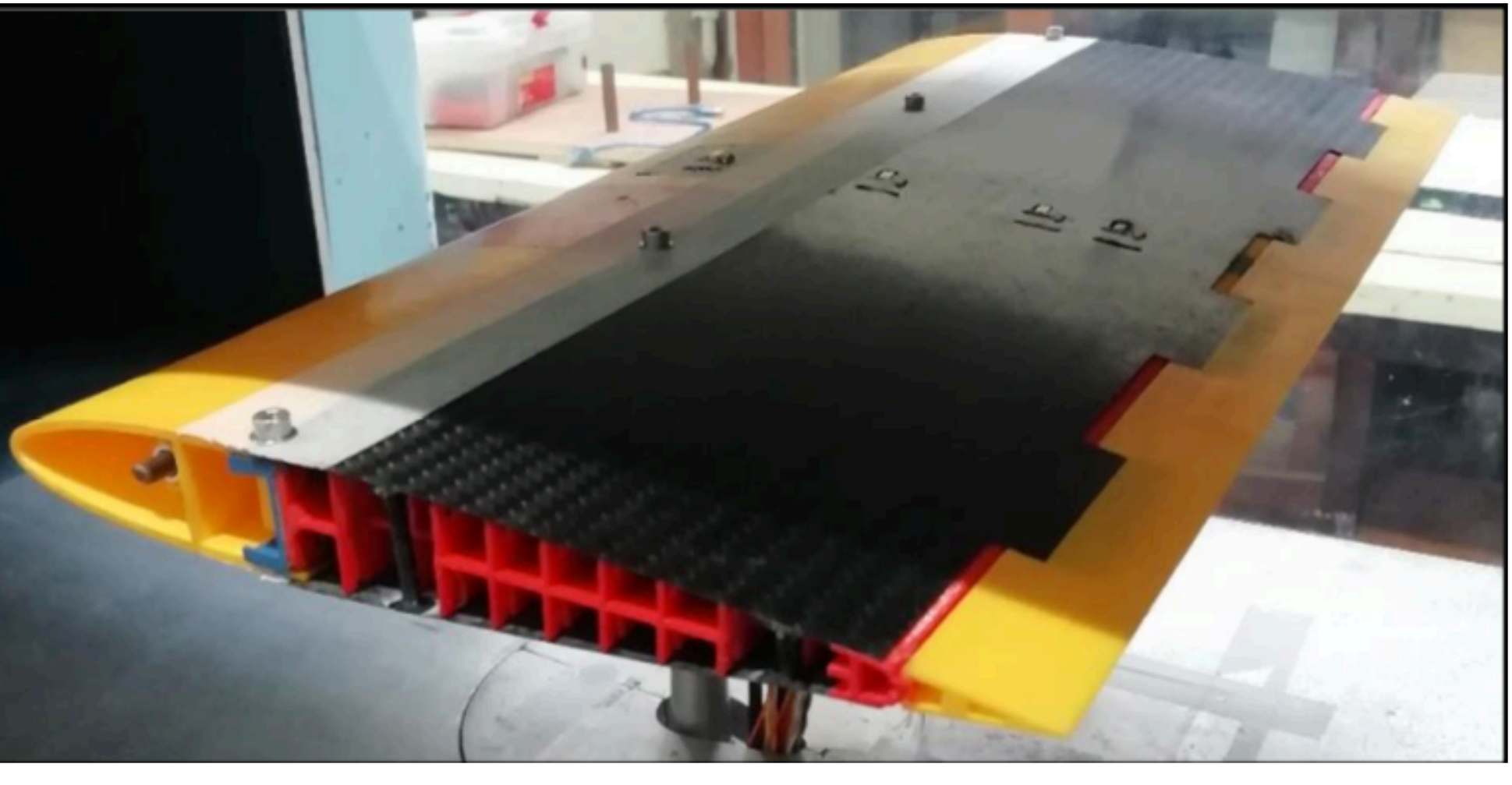
Prototipo

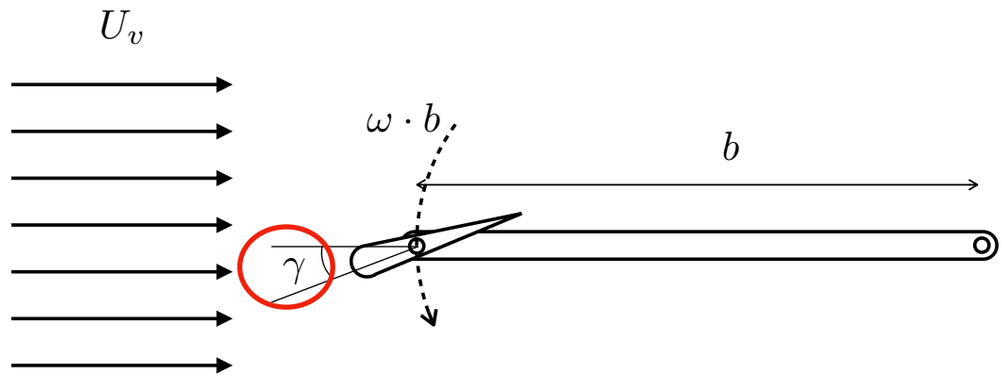




Créditos: Alex Flores (DIMEC)

Preguntas

Ángulo con respecto a la posición?



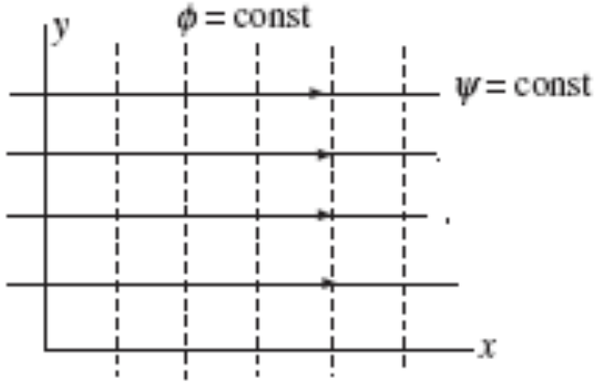
Fuerza sobre los perfiles alares?

Potencia a X rpm?

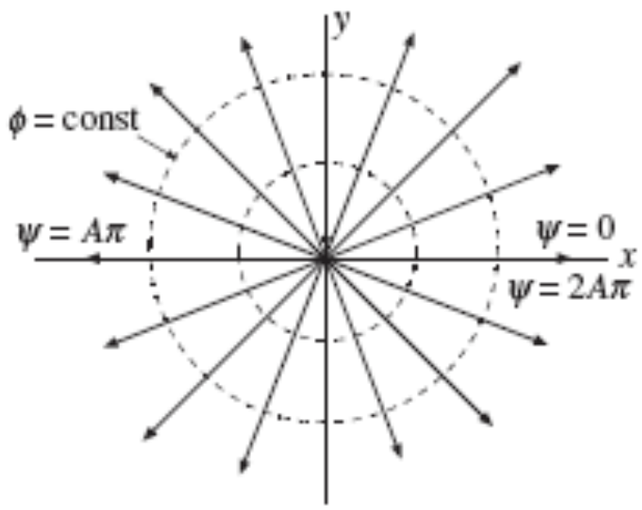
Modelo: flujo potencial

Flujo incompresible (div(V)=0) y no viscoso (curl(V)=0)

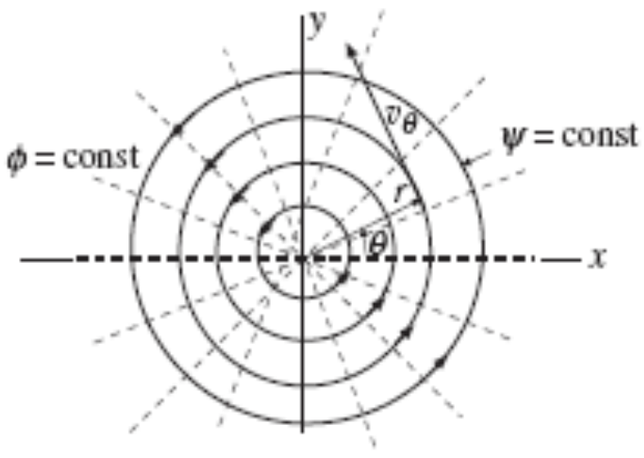
$$\nabla \cdot \mathbf{V} = \nabla \cdot \nabla\phi = \nabla^2\phi = 0$$



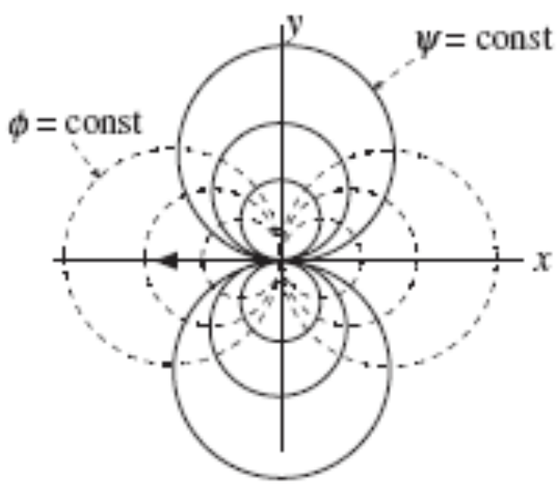
(*a*) Uniform flow in the *x*-direction



(*b*) Line source



(*c*) Vortex



(*d*) Doublet

Flujo uniforme horizontal (dirección $+x$):

$$u = U_\infty \quad v = 0$$
$$\phi = U_\infty x \quad \psi = U_\infty y$$

Flujo uniforme vertical (dirección $+y$):

$$u = 0 \quad v = V_\infty$$
$$\phi = V_\infty y \quad \psi = -V_\infty x$$

Fuente:

$$V_r = \frac{q}{2\pi r} \quad V_\theta = 0$$
$$\phi = \frac{q}{2\pi}\ln(r) \quad \psi = \frac{q}{2\pi}\theta$$

Sumidero:

$$V_r = -\frac{q}{2\pi r} \quad V_\theta = 0$$
$$\phi = -\frac{q}{2\pi}\ln(r) \quad \psi = -\frac{q}{2\pi}\theta$$

Vórtice (dirección contra reloj):

$$V_r = 0 \quad V_\theta = \frac{\Gamma}{2\pi r}$$
$$\phi = \frac{\Gamma}{2\pi}\theta \quad \psi = -\frac{\Gamma}{2\pi}\ln(r).$$

Método del panel

Hess y Smith (~1960): sistema lineal para fuerza del vórtice