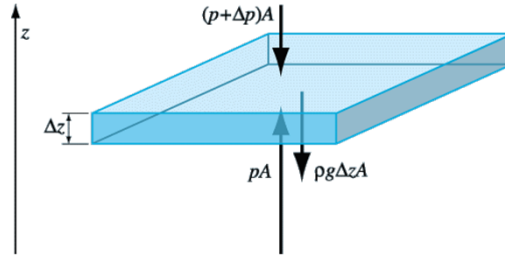


静水圧



$$\Delta p = -\rho g \Delta z$$

$$\frac{dp}{dz} = -\rho g$$

$$\int_p^{p_s} dp = -\rho g \int_{-d}^0 dz$$

$$p = \rho g d$$

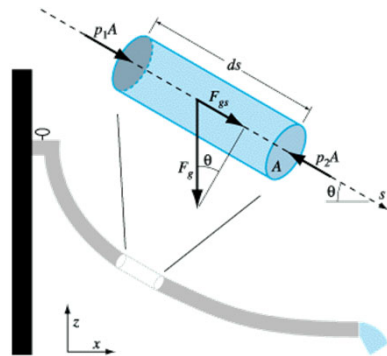
1

ベルヌイの定理

$$(1) ma = (\rho dsA)a = \rho dsAu \frac{du}{ds}$$

$$a = \frac{du}{dt} = \frac{\partial u}{\partial t} + \frac{\partial u}{\partial s} \frac{ds}{dt}$$

$$= u \frac{du}{ds}$$



$$(2) F_p = -\frac{dp}{ds} dsA$$

$$(3) F_{gs} = -\frac{dz}{ds} \rho g dsA$$

$$(1) = (2) + (3)$$

$$u \frac{du}{ds} + g \frac{dz}{ds} + \frac{1}{\rho} \frac{dp}{ds} = 0$$

2

$$\frac{d}{ds} \left(\frac{u^2}{2g} + z + \frac{p}{\rho g} \right) = 0 \quad \boxed{u \frac{du}{ds} = \frac{1}{2} \frac{d(u^2)}{ds}}$$

$$\boxed{\frac{u^2}{2g} + z + \frac{p}{\rho g} = \text{const.}}$$

↓ × mg

$$\frac{1}{2} \mu u^2 + mgz + pV = \text{const.}$$

3

ベルヌイの定理の応用

- 溪流流速
- 水位－流量関係
- ⋮
- ⋮

**エネルギー損失、
層流⇔乱流、常流⇔射流**

4