Mavzu: Suyuqlik harakatining kinematikasi.

Suyuqlik oqimining uzluksizlik tenglamasi.

«Gidravlika va gidroinformatika»
kafedrasi v.b. dotsenti   S.N.Xoshimov

REJA:

1. Suyuqlik harakatining turlari;

2. Oqimning asosiy gidravlik elementlari;

3. Suyuqlik oqimining uzluksizlik tenglamasi.

"BBB" jadvali

Bilardim	Bilishni hoxlagan edim	Bilib oldim
1.Gidrostatikannng asosiy tenglamasi va uning natijalari; 2.Tekis sirtga ta'sir etayotgan gidrostatik bosim kuchi va unini aniqlash usullari; 3. Gidrostatik bosim markazi; 4. Ariximed qonuni.	1. Suyuqlik harakatining turlari; 2. Oqimning asosiy gidravlik elementlari; 3. Suyuqlik oqimining uzluksizlik tenglamasi.	

Gidrostatika bo`limi:

p- bosim

MDS

p

h
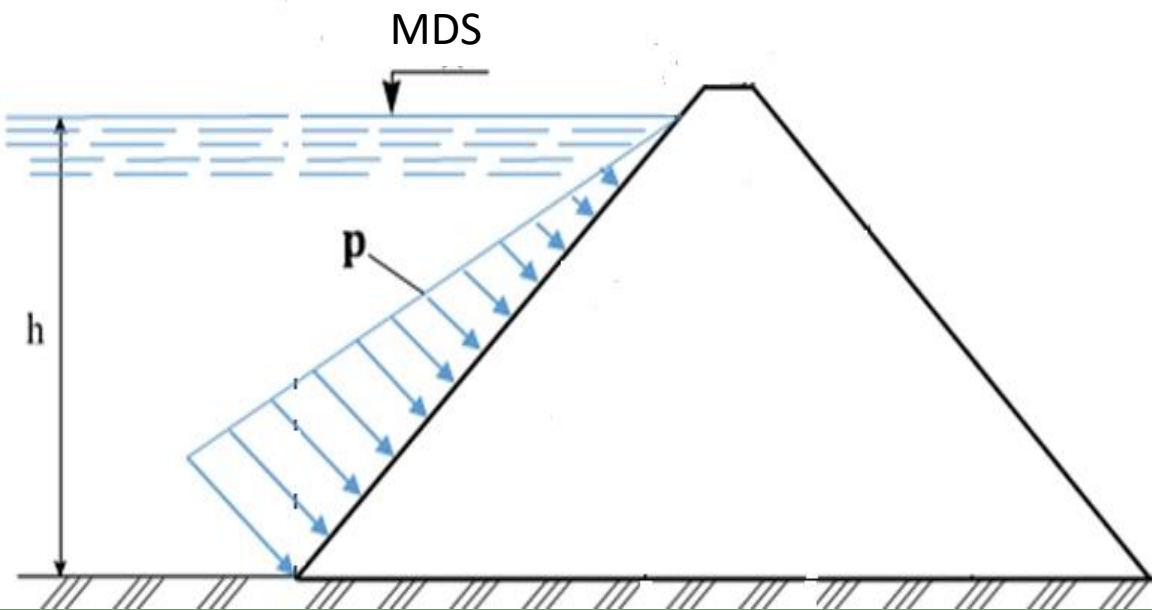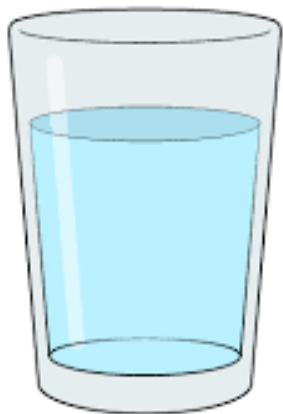
Gidrodinamika bo`limi:

p- bosim
u - tezlik

**Gidravlikaning gidrodinamika bo`limida** xarakatdagi suyuqlik qonunlari o`rganiladi va ularning amaliyotga tadbiqi ko`riladi.

Gidrodinamikaning asosiy tushunchasi **tezlik** *(u)* va **bosimdir** *(p)*. Tezlik hamda bosim vaqt va koordinata bo`yicha o`zgaruvchandir.

Suyuqlik harakatini tadqiqotida ikkita uslubga asoslananadi:

1. Lagranj uslubi;
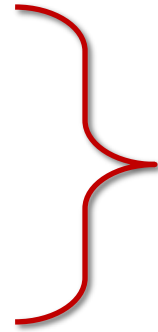
2. Eyler uslubi.

Suyuqlik harakatining turlari

1. Beqaror va barqaror harakat;

2. Tekis va notekis harakat;

3. Naporli va naporsiz harakat.
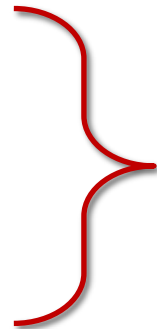
I. Beqaror va barqaror harakat

p= $f_1(x; y; z; t)$

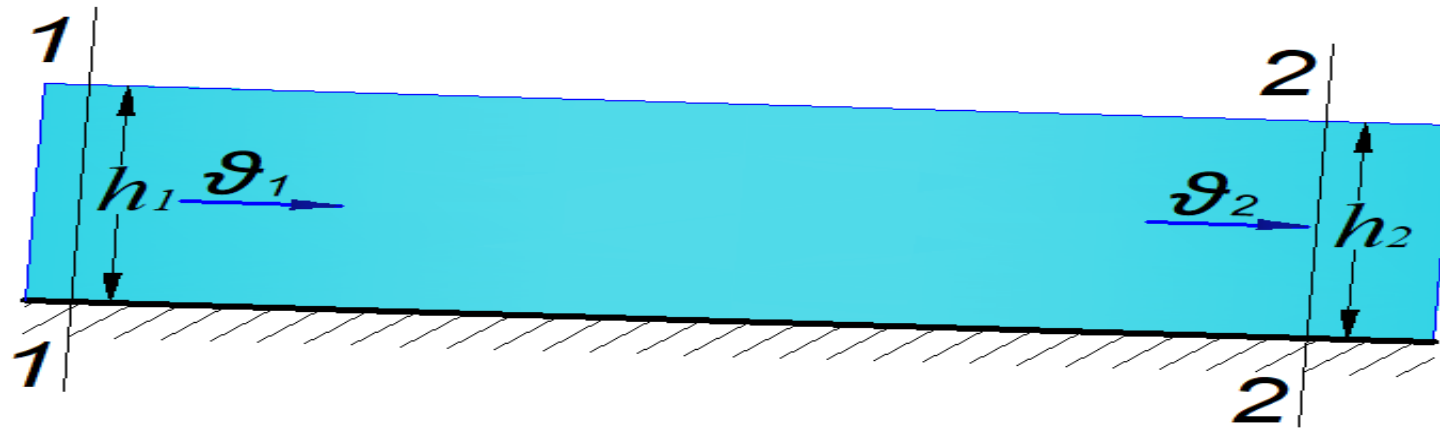u= $f_2(x; y; z; t)$

Beqaror harakat;

p= $f_1(x; y; z)$

u= $f_2(x; y; z)$

Barqaror harakat.

II. Tekis va notekis harakat

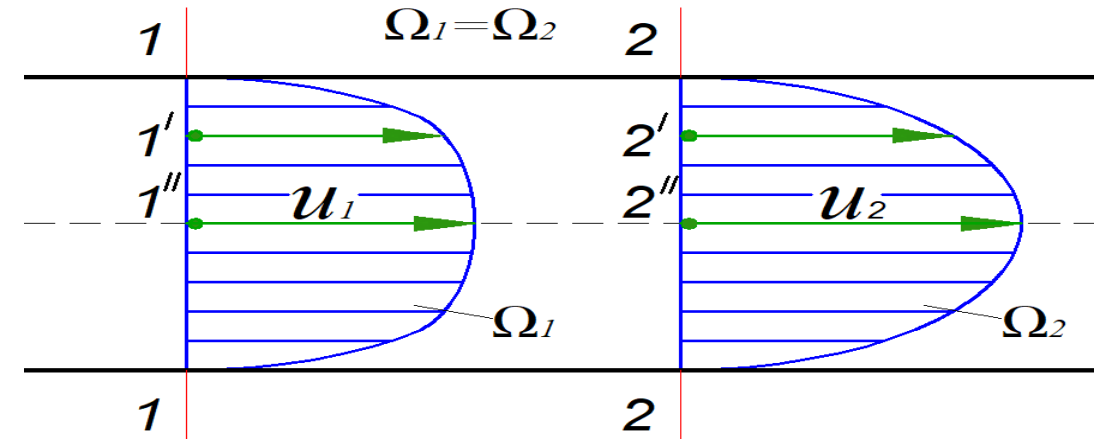$$h_1 = h_2$$
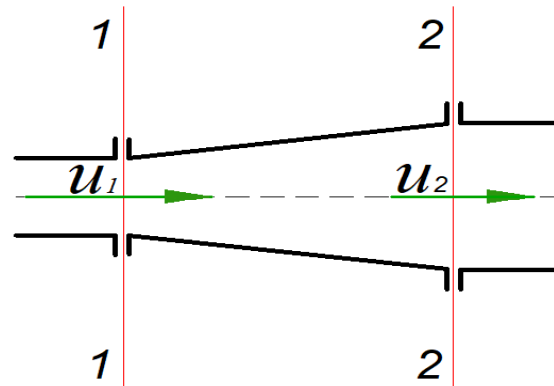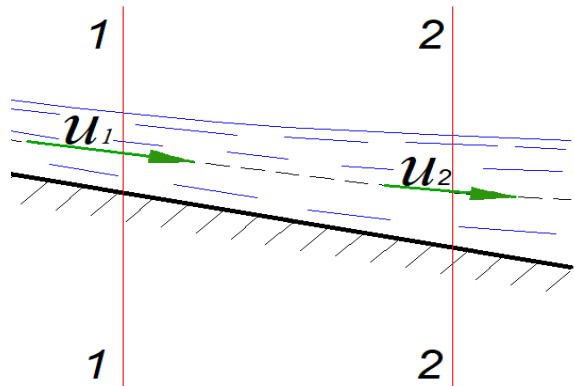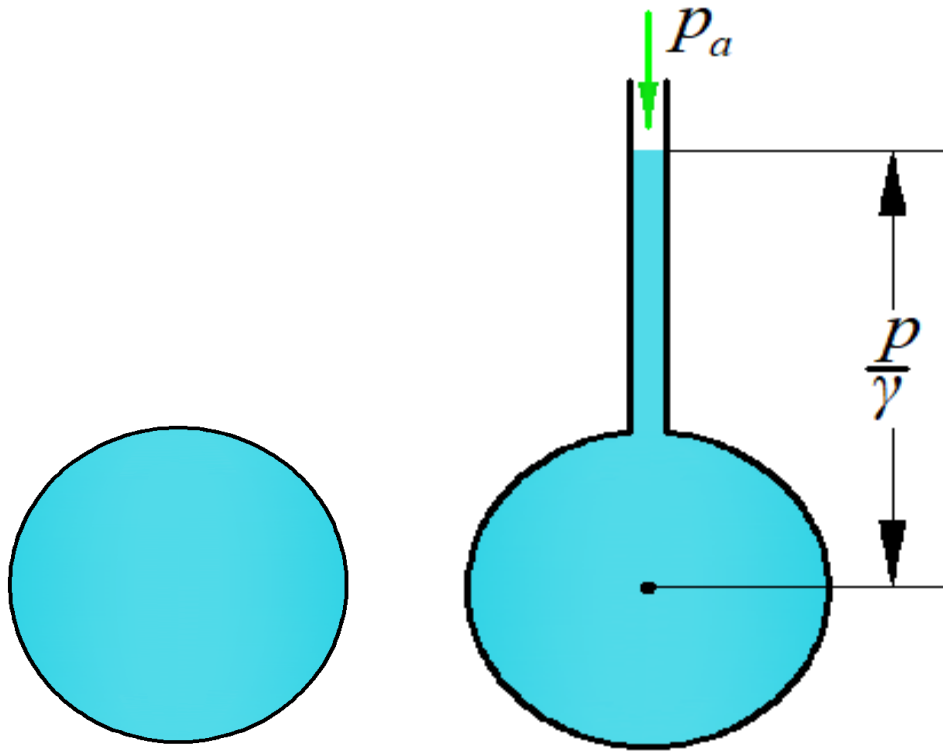
$$\vartheta_1 = \vartheta_2$$

$$\omega_1 = \omega_2$$

a) tekis harakat

b) notekis harakat

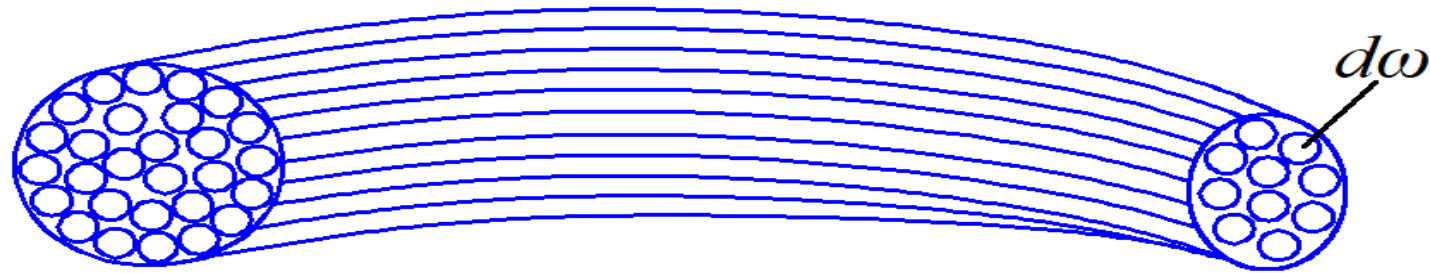# III. Naporli va naporsiz harakat

p_a

$\dfrac{p}{\gamma}$
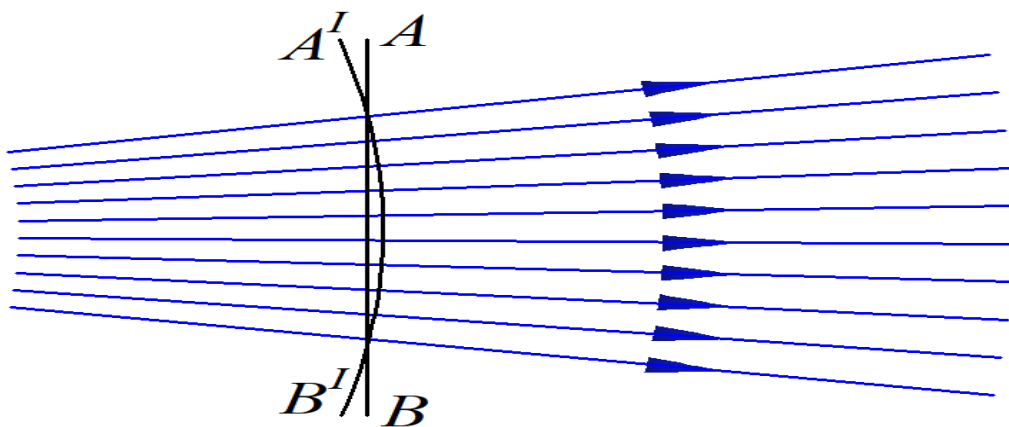
p_a

a) naporli
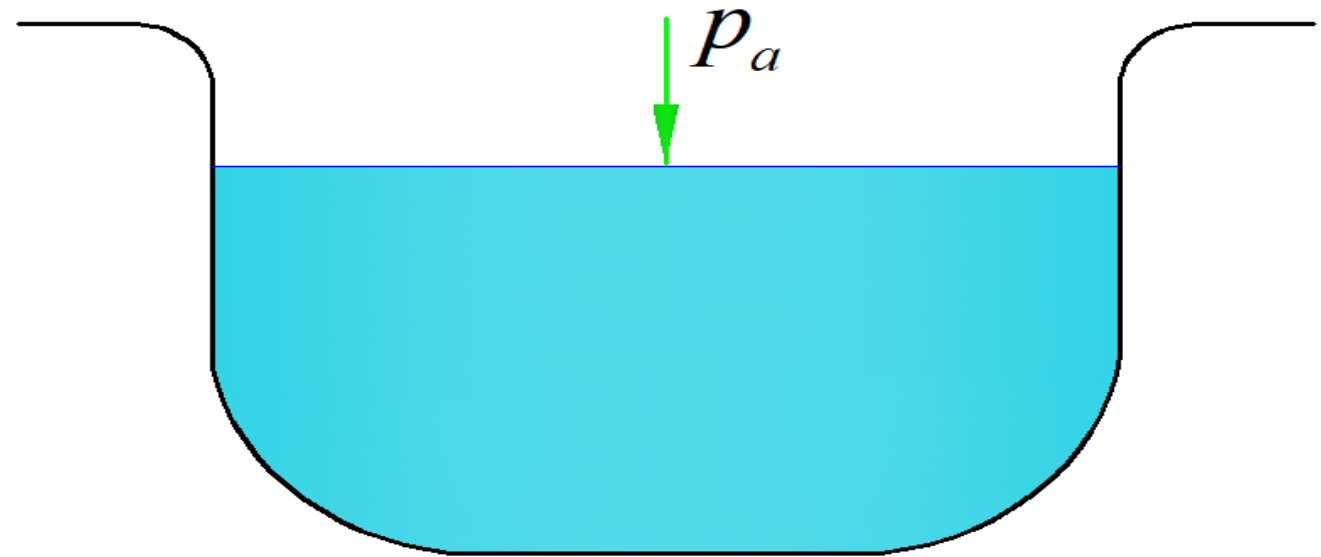
b) naporsiz

Oqimning asosiy gidravlik elementlari

Elementar oqimchalar yig'indisiga *oqim* deyiladi.

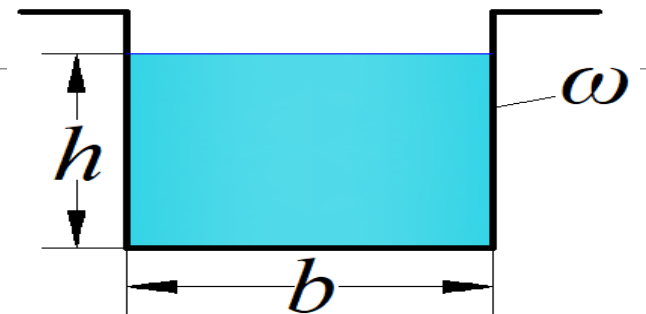**1. Harakat kesimi –** oqim yo'nalishiga normal bo'lgan ko'ndalang kesim yuzasi.

$$\omega = \int_{\omega} d\omega \quad (\text{m}^2)$$

Harakat kesimlari
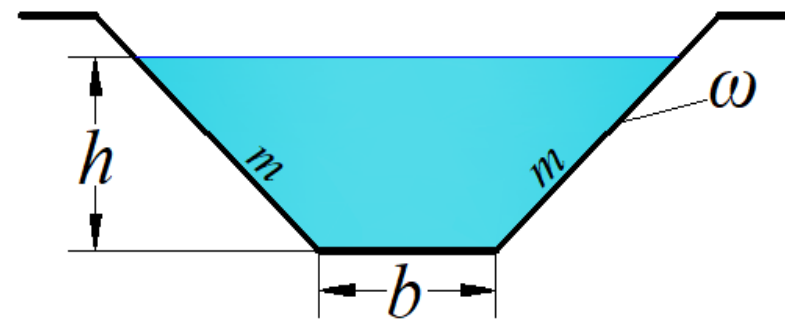
To'g'ri to'rtburchak kanal uchun:

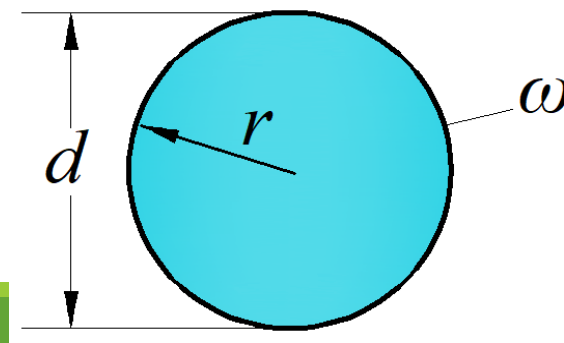$$\omega = b \cdot h, \qquad m^2$$

Trapetsiadal kanal uchun:

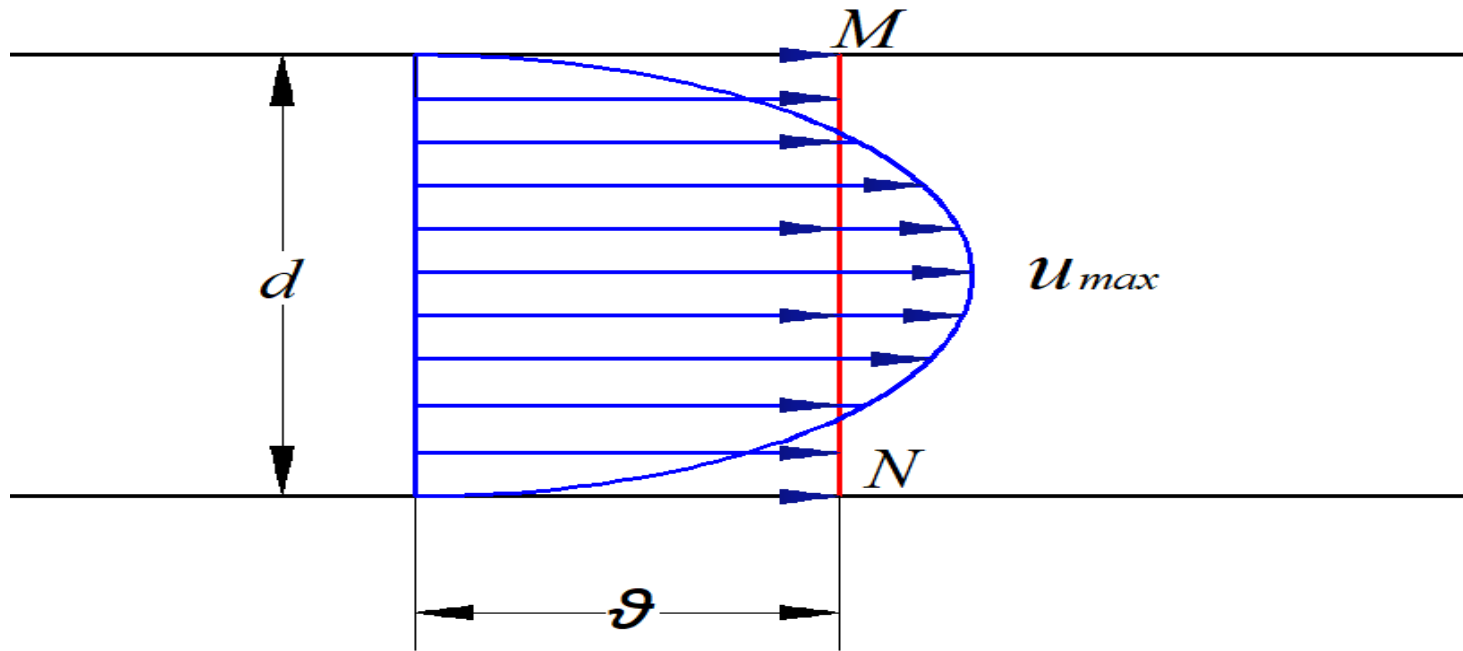$$\omega = (b + m \cdot h)h, \qquad m^2$$

Silindrik quvurlar uchun:

$$\omega = \frac{\pi \cdot d^2}{4} = \pi \cdot r^2, \qquad m^2$$

2. Sarf –vaqt birligida harakat kesimidan oqib o'tgan suyuqlik miqdori:

$$Q = V/t; \qquad Q = \int u\, d\,\omega; \qquad m^3/s, \qquad \frac{l}{s};$$
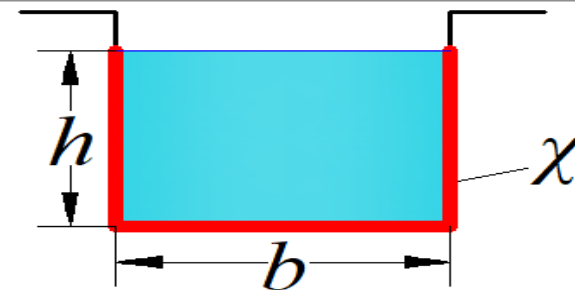

V – hajm;

t – vaqt.

u– nuqtadagi tezlik.

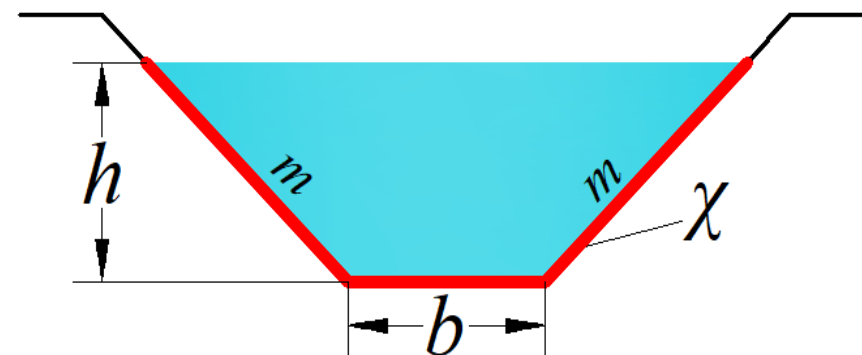# 3. Ho'llangan perimetr – oqimni qattiq sirt bilan chegaralangan qismi uzunligi.

To'g'ri to'rtburchak kanal uchun:

$$\chi = b + 2h, \qquad m;$$

Trapetsiadal kanal uchun:

$$\chi = b + 2h\sqrt{1 + m^2}, \qquad m;$$

Silindrik quvurlar uchun:

$$\chi = \pi \cdot d = 2 \cdot \pi \cdot r, \qquad m;$$
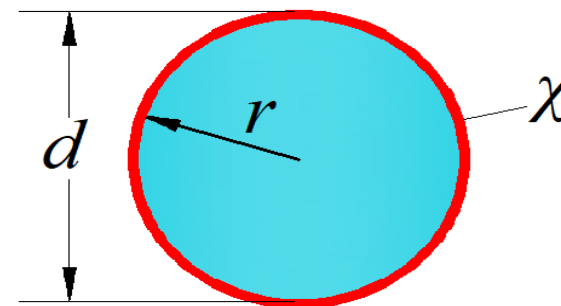
4. Gidravlik radius – oqim harakat kesimining ho'llangan perimetriga nisbati:

$$R = \frac{\omega}{\chi}; \quad (m)$$

To'g'ri to'rtburchak kanal uchun:

$$R = \frac{\omega}{\chi} = \frac{b \cdot h}{2h + b};$$
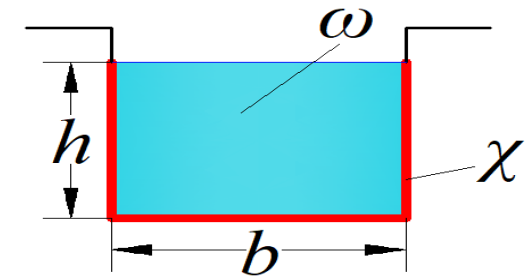
Trapetsiadal kanal uchun:

$$R = \frac{\omega}{\chi} = \frac{(b + mh)h}{b + 2h\sqrt{1 + m^2}};$$
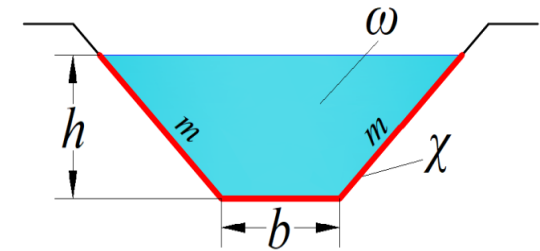
Silindrik quvurlar uchun:

$$R = \frac{\omega}{\chi} = \frac{\pi r^2}{2\pi r} = \frac{r}{2};$$
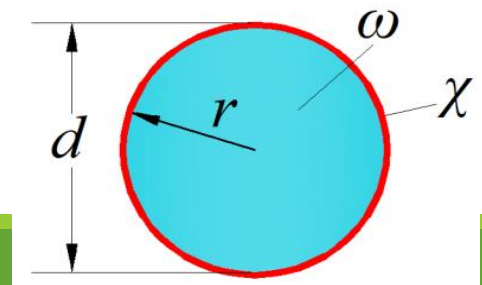
5. O'rtacha tezlik – suyuqlik sarfining harakat kesimiga nisbati:

$$\vartheta = \frac{Q}{\omega} = \frac{\int_{\omega} u d\omega}{\omega}; \ m/s$$
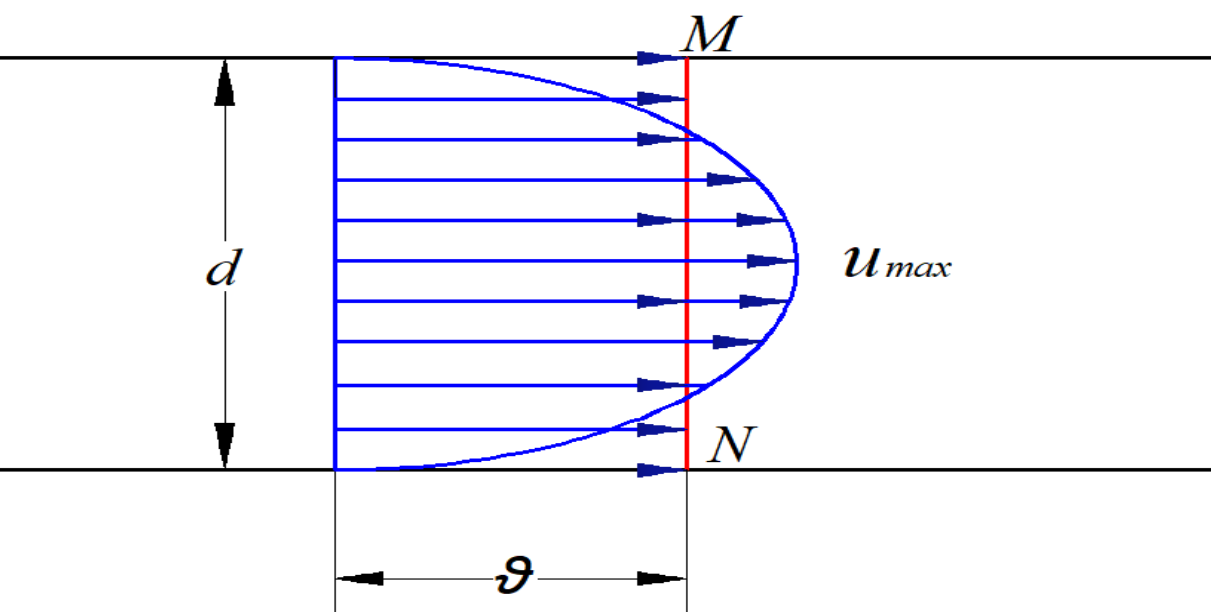
a) naporli
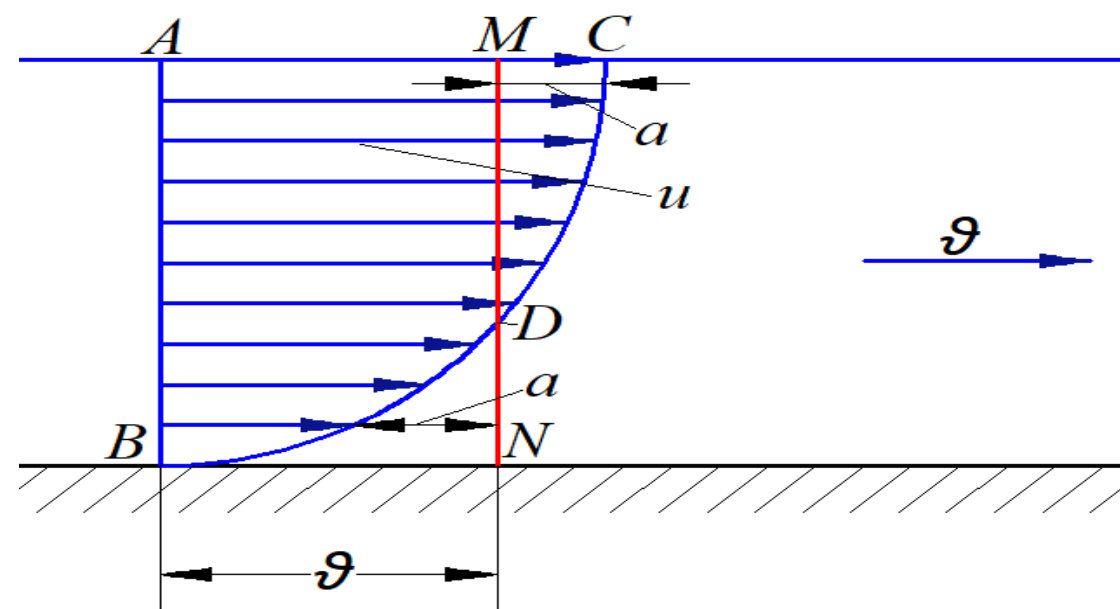
b) naporsiz

Suyuqlik oqimining uzluksizlik tenglamasi
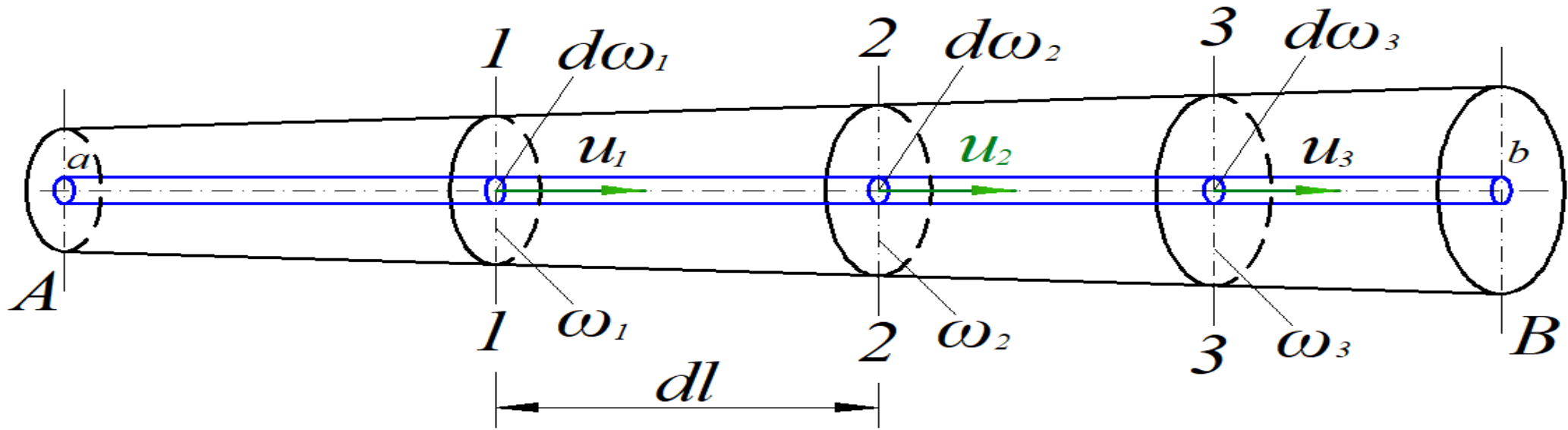
$$\frac{\partial (dQ)}{\partial l} + \frac{\partial (d\omega)}{\partial t} = 0 \qquad (1)$$

Barqaror harakatda:

$$\frac{\partial(d\omega)}{\partial t} = 0 \qquad (2)$$

$$dQ = ud\omega = cons't \qquad (3)$$

Elementar oqim uchun:

$$u_1 d\omega_1 = u_2 d\omega_2 = u_3 d\omega_3 = cons't \qquad (4)$$

(4) ifodani integrallaymiz:

$$\int\limits_{\omega} u_1 d\omega_1 = \int\limits_{\omega} u_2 d\omega_2 = \int\limits_{\omega} u_3 d\omega_3 \qquad \text{(5)}$$

$$Q = \vartheta_1 \omega_1 = \vartheta_2 \omega_2 = \vartheta_3 \omega_3 = cons't \qquad \text{(6)}$$

$$\frac{\vartheta_1}{\vartheta_2} = \frac{\omega_2}{\omega_1} \qquad \text{(7)}$$

1-misol

Silindrik quvurda xarakatlanayotgan suv oqimining gidravlik elementlari va sarfini aniqlang.
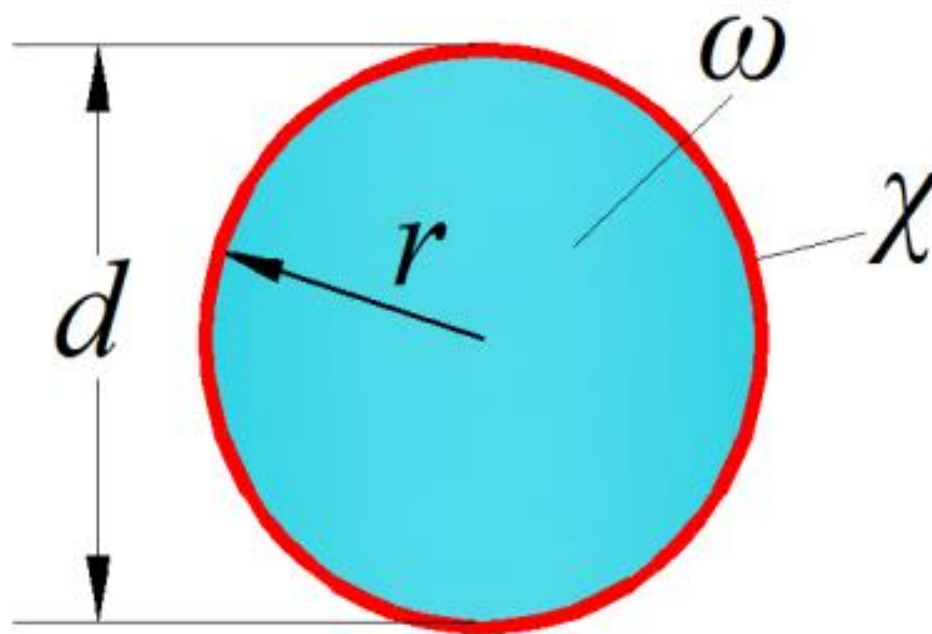
Berilgan:

$$d = 200 \ mm;$$

$$\vartheta = 1,2 \ m/s;$$

$$\omega = ? \qquad \chi = ?$$

$$R = ? \qquad Q = ?$$

Yechim:

1. Harakat kesim yuzasi

$$\omega = \frac{\pi d^2}{4} = \frac{3,14 \cdot 0,2^2}{4} = 0,0314 \ m^2$$

2. Ho'llanganlik perimetri

$$\chi = \pi d = 3,14 \cdot 0,2 = 0,628 \ m$$

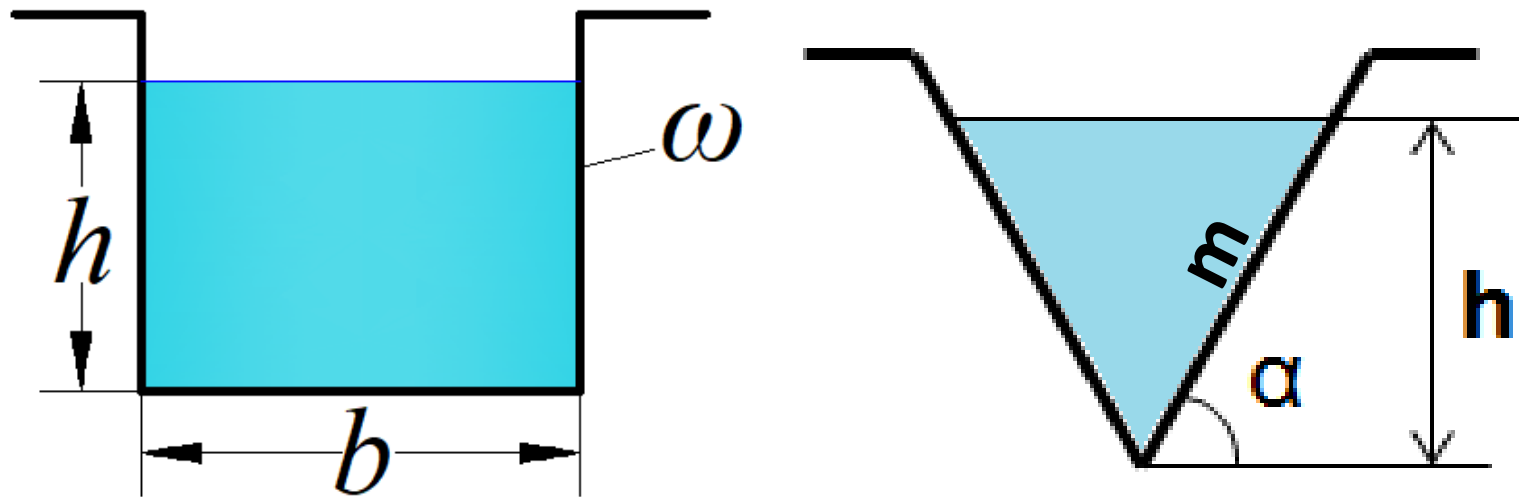**3. Gidravlik radius**

$$R = \frac{\omega}{\chi} = \frac{0,0314}{0,628} = 0,05 \ m; \qquad R = \frac{d}{4} = \frac{r}{2} = \frac{0,1}{2} = 0,05 \ m;$$

4. Suv sarfi

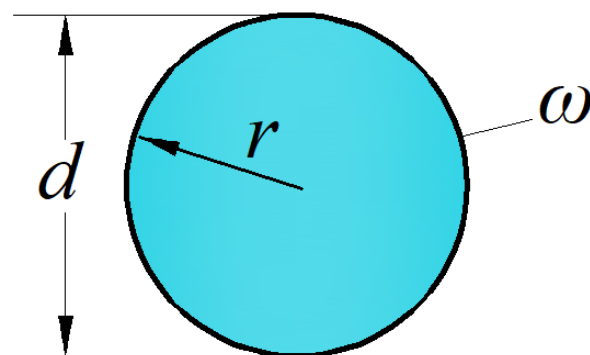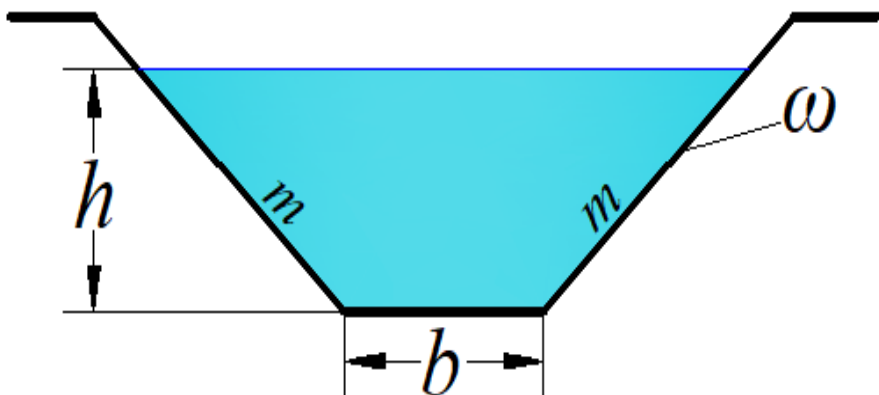$$Q = \omega \cdot \vartheta = 0,0314 \cdot 1,2 = 0,03768 \ m^3/s = 37,68 \ l/s$$

Mustaqil bajarish uchun:

$$h = N_1 \; m; \quad b = N_2 \; m;$$

$$m = 1; \quad \vartheta = 1,2 m/s$$

$$d = 0,5 N_2 sm;$$

N_1 -Ismingizdagi xarflar soni

N_2 -Familiyangizdagi xarflar soni

$$\chi = ? \quad \omega = ?$$

$$R = ? \quad Q = ?$$

Foydalanishga tavsiya etilgan adabiyotlar

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Murojat uchun manzillar

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