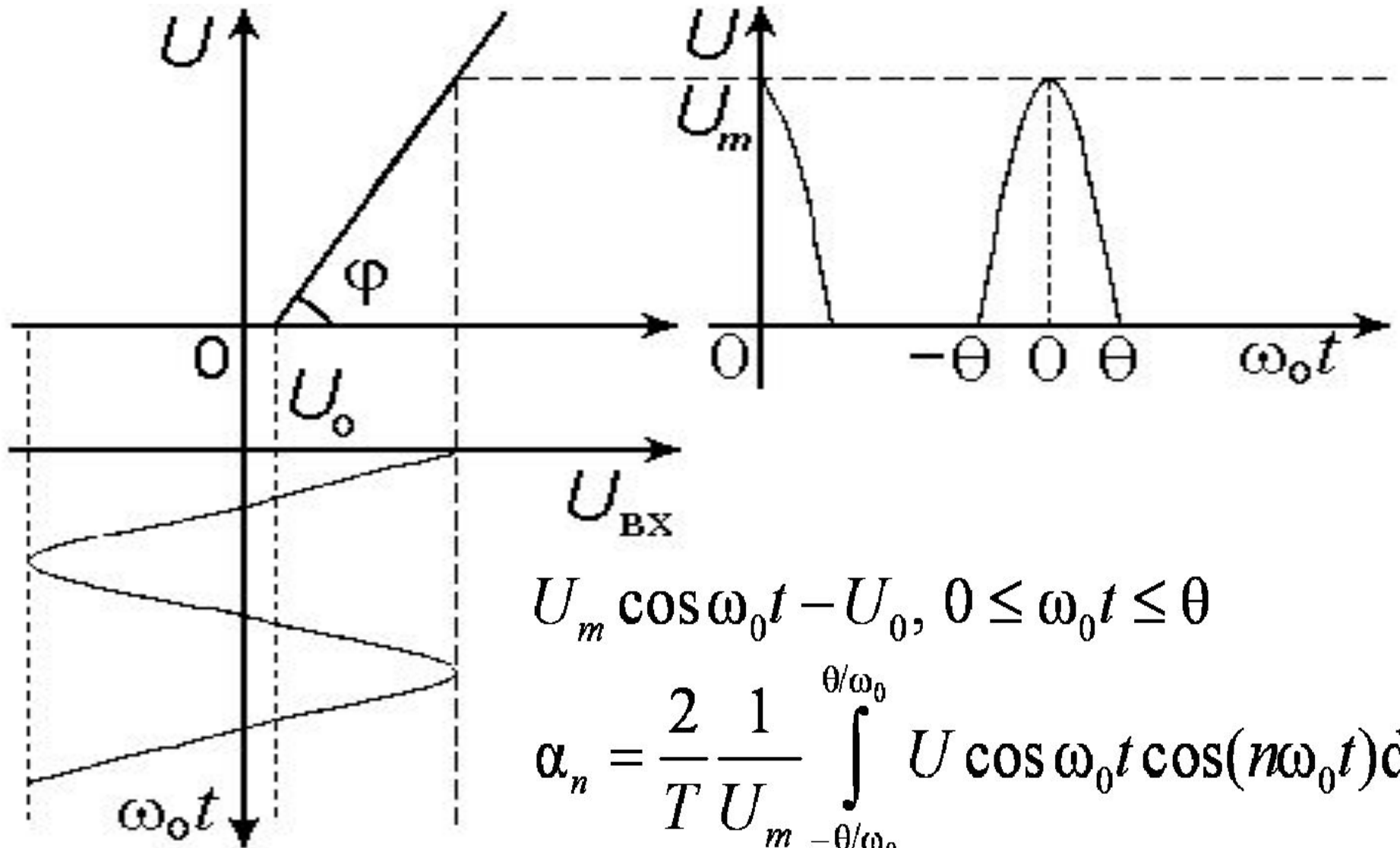
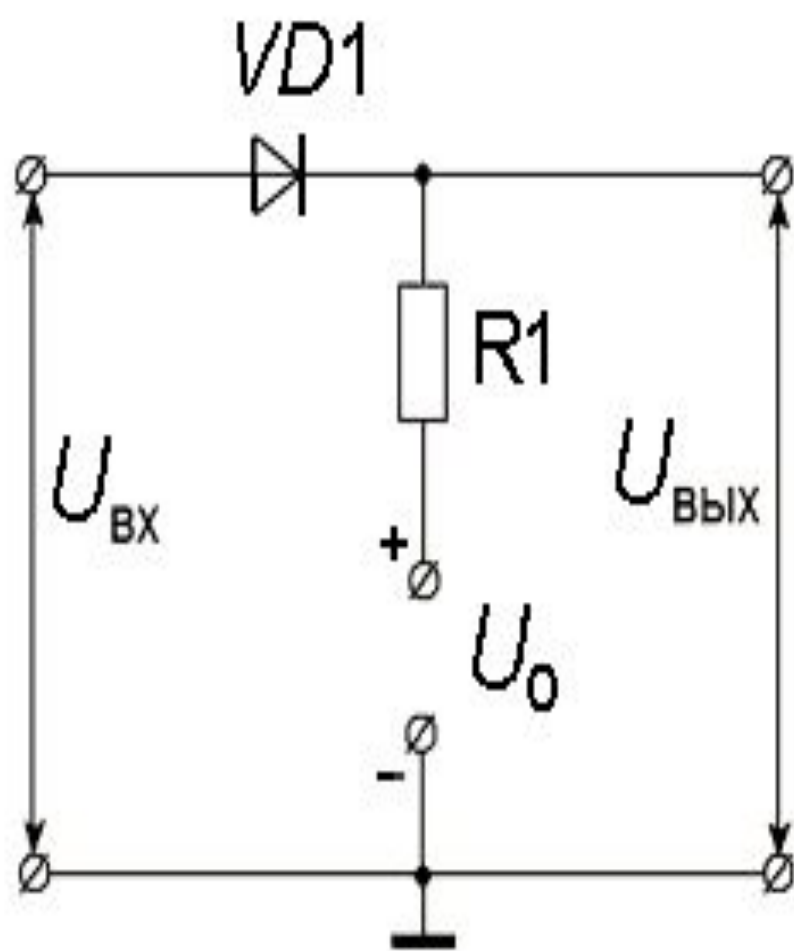


# Детектирование

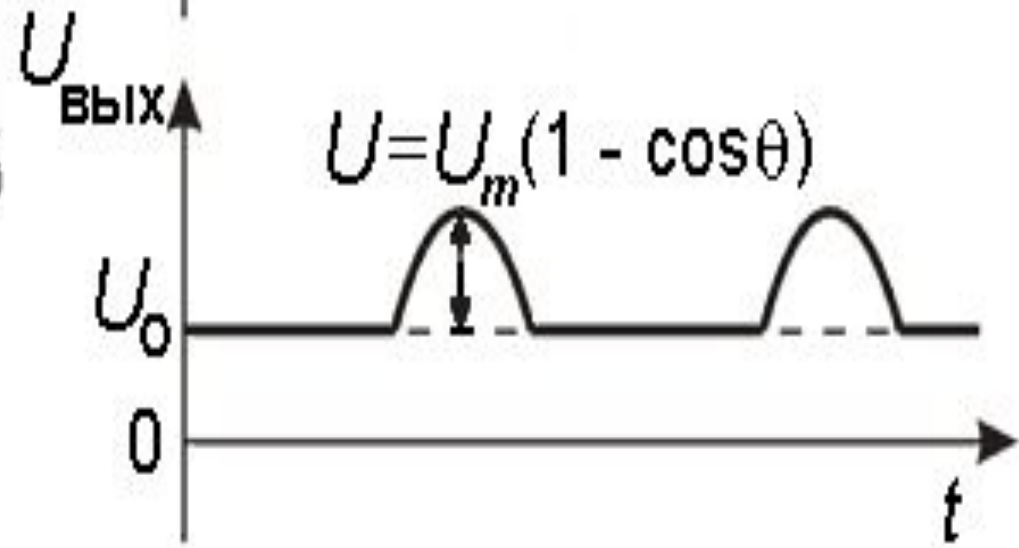
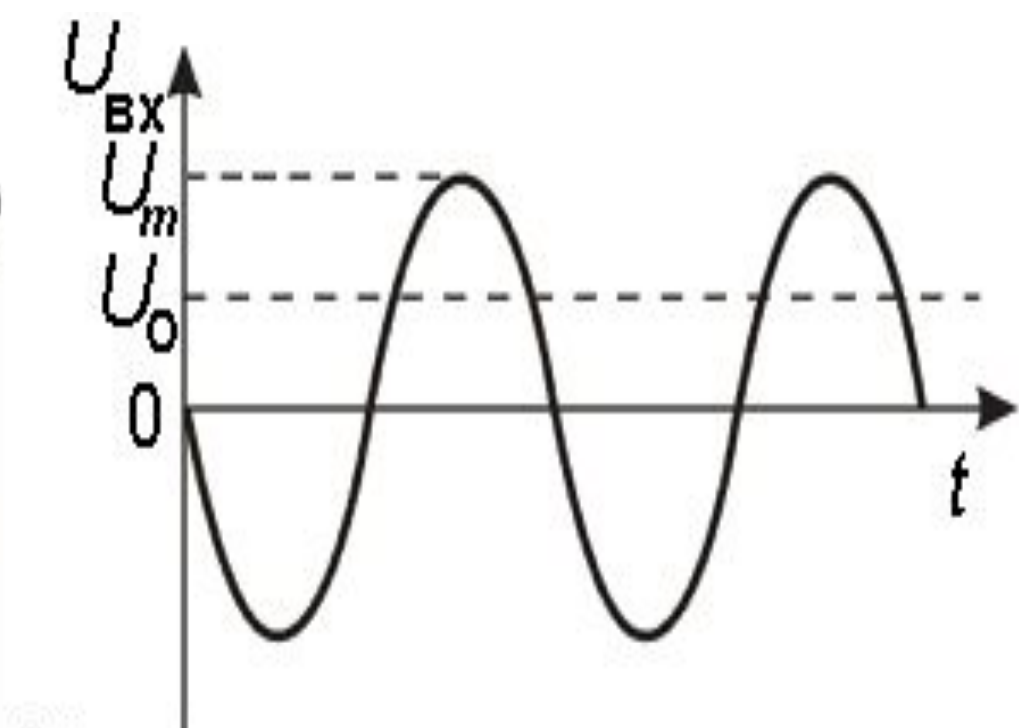


$$U_m \cos \omega_0 t - U_0, 0 \leq \omega_0 t \leq \theta$$

$$\alpha_n = \frac{2}{T} \frac{1}{U_m} \int_{-\theta/\omega_0}^{\theta/\omega_0} U \cos \omega_0 t \cos(n\omega_0 t) dt$$



$$\cos \theta = \frac{U_0}{U_m}$$



## Коэффициенты Берга

$$\alpha_n(\theta) = \frac{2}{T} \frac{1}{U_m} \int_{-\theta/\omega_0}^{\theta/\omega_0} U \cos \omega_0 t \cos(n\omega_0 t) dt$$

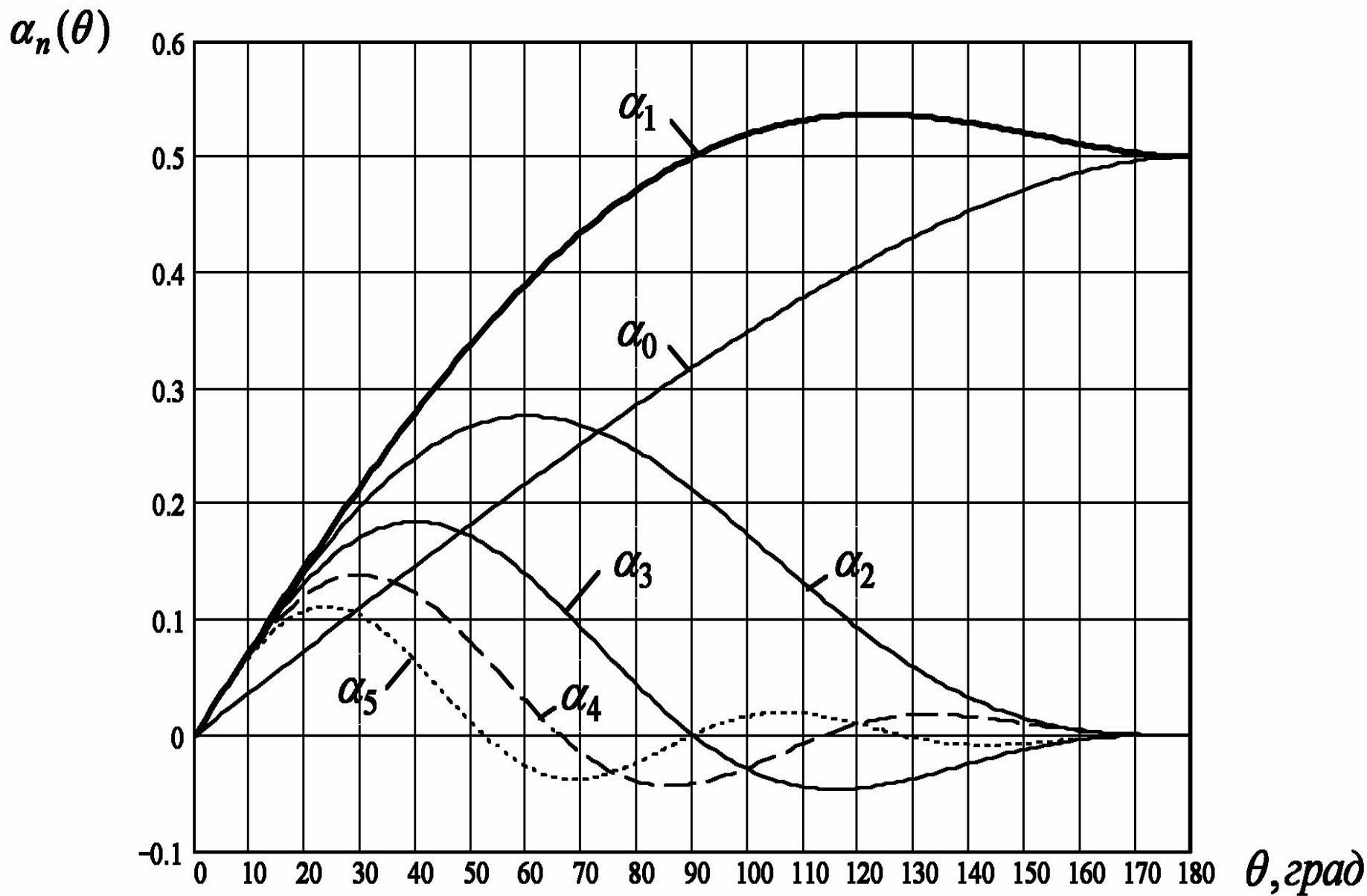
$$\alpha_0(\theta) = \frac{\sin \theta - \theta \cos \theta}{\pi (1 - \cos \theta)},$$

$$\alpha_1(\theta) = \frac{\theta - \sin \theta \cos \theta}{\pi (1 - \cos \theta)},$$

$$\alpha_n(\theta) = \frac{2}{\pi} \cdot \frac{\sin(n\theta) \cdot \cos \theta - n \cos(n\theta) \cdot \sin \theta}{n(n^2 - 1) \pi (1 - \cos \theta)},$$

$$n = 2, 3, 4, \dots$$

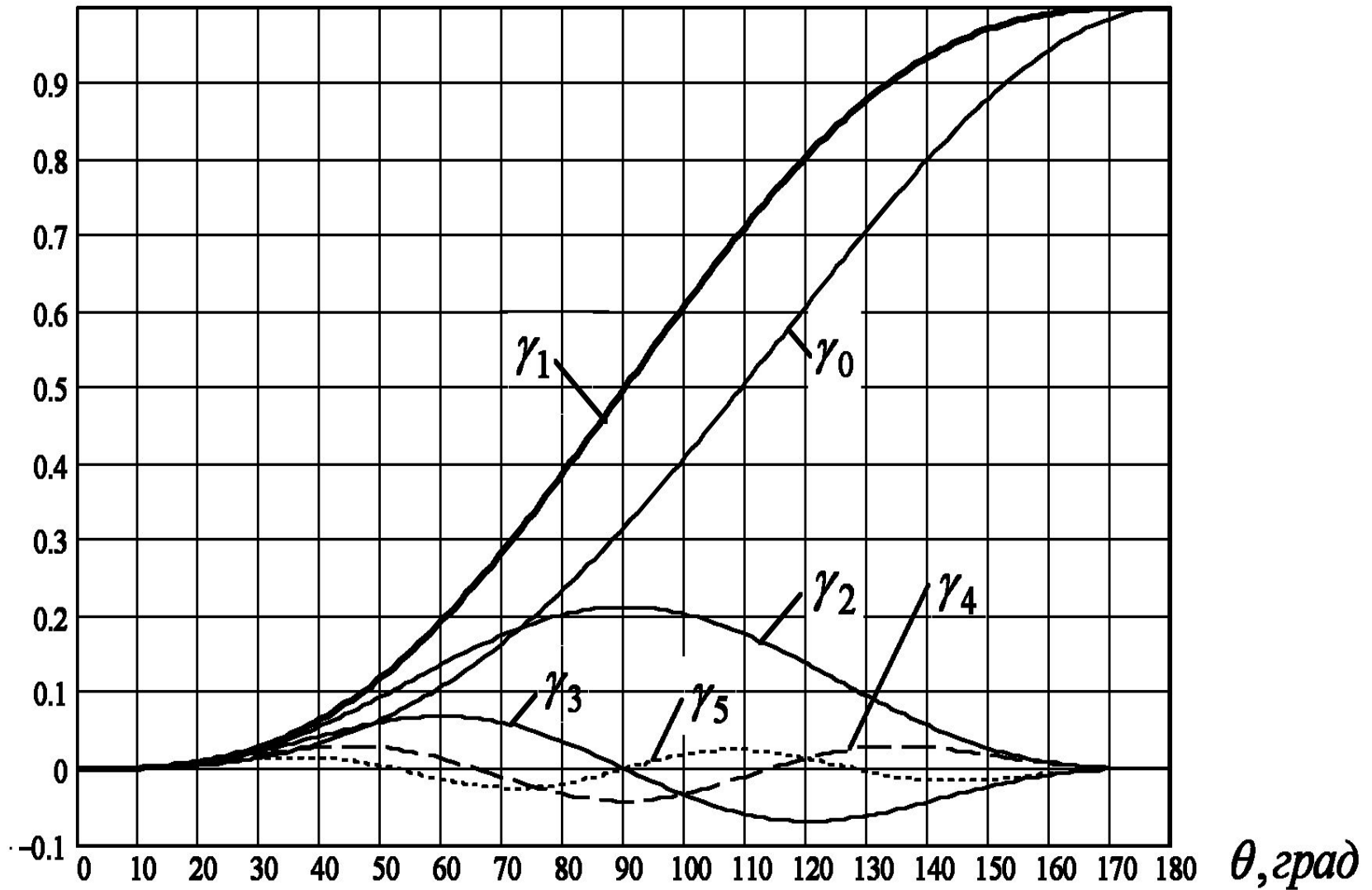
# Коэффициенты Берга



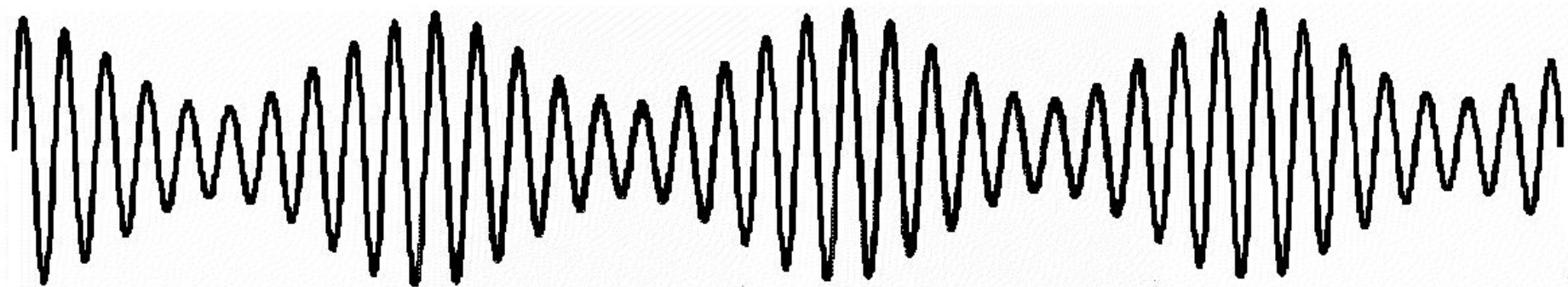
# Функции Берга

$$\gamma_n(\theta) = (1 - \cos \theta) \alpha_n$$

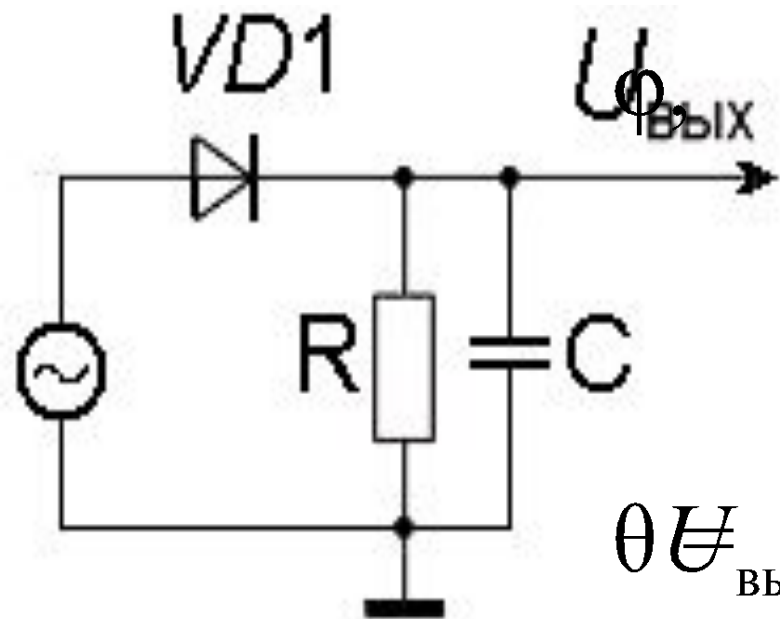
$\gamma_n(\theta)$



# Амплитудный линейный диодный детектор



$$s(t) = A_0 (1 + m \cos \Omega t) \cos \omega_0 t \quad \Omega \ll \omega_0$$



$$R \gg R_i, \quad \frac{1}{R \omega_0} \ll \frac{1}{RC \Omega}$$

$$U_{\text{ВЫХ}} \approx U_0, \quad \cos \frac{U_0}{A_0 m \cos \Omega t}$$

$$A_0 m \cos \Omega t - U_0 = I_0 R = SRU \gamma_0 = SRU \frac{\sin \theta - \theta \cos \theta}{\pi}$$

$$k_{\text{д}} = \cos \theta, I_0 R \approx U, \frac{I_0 R}{U} \approx 1, SR = \frac{\sin \theta - \theta \cos \theta}{\pi},$$

$$\frac{\pi}{SR \cos \theta} = \operatorname{tg} \theta - \theta, \theta \approx 0, \cos \theta \approx 1,$$

$$\operatorname{tg} \theta = \theta + \frac{\theta^3}{3} + \frac{2\theta^5}{15} + \dots, \theta^3 = \frac{3\pi}{RS}, k_{\text{д}} = \cos \sqrt{\frac{3\pi}{RS}}$$

$$R_{\text{BX}} = \frac{U}{I_1} = \frac{U}{SU \gamma_1(\theta)} = \frac{1}{S \gamma_1(\theta)} = \frac{\pi}{S(\theta - \frac{1}{2} \sin 2\theta)},$$

$$R_{\text{BX}} = \frac{\pi}{S(\theta - \theta + \frac{2\theta^3}{3} + \dots)} = \frac{3\pi RS}{6\pi S} = \frac{R}{2}.$$

# Амплитудный квадратичный диодный детектор

$$U_{\text{ВЫХ}} = S [A_0 (1 + m \cos \Omega t) \cos \omega_0 t]^2 = SA_0^2 \cos^2 \omega_0 t +$$

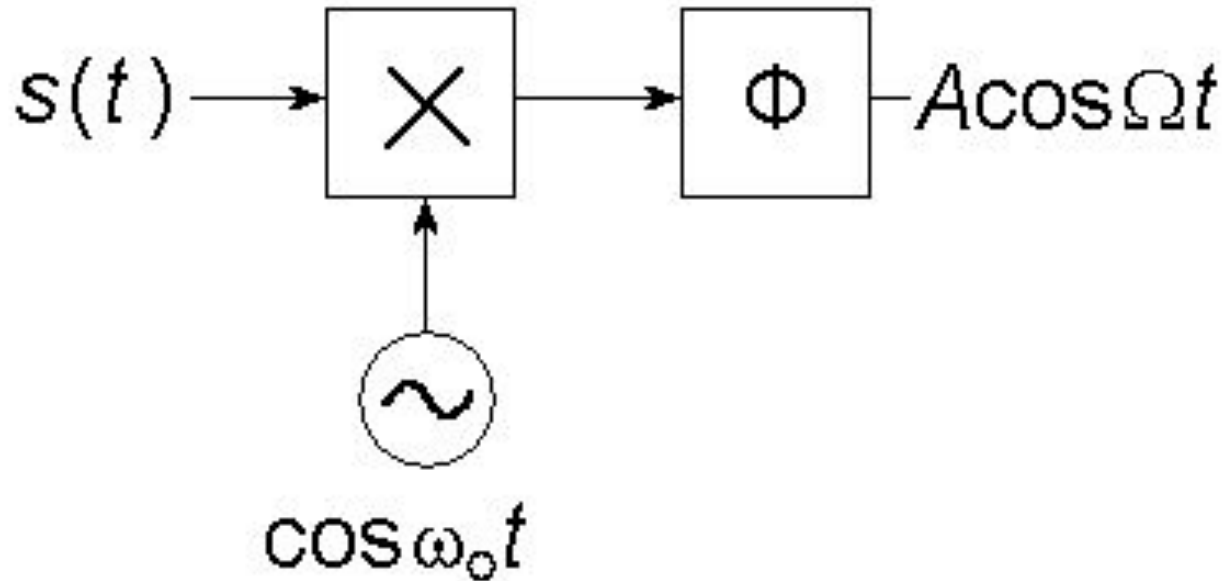
$$+ SA_0^2 m^2 \cos^2 \Omega t \cos^2 \omega_0 t + 2 SA_0^2 m \cos \Omega t \cos \omega_0 t$$

$$\cos^2 x = \frac{1}{2} + \frac{1}{2} \cos 2x$$

$$U_{\text{НЧ}} = \frac{1}{2} SA_0^2 + \frac{1}{4} SA_0^2 m^2 + \frac{1}{4} SA_0^2 m^2 \cos 2\Omega t + SA_0^2 m \cos \Omega t$$



# Синхронное детектирование



$$A_0 (1 + m \cos \Omega t) \cos \omega_0 t \times \cos \omega_0 t$$

$$U_{\text{нч}} = \frac{1}{2} S A_0 + S A_0 m \cos \Omega t$$

$$A_0 \cos(\omega t + \varphi) = \epsilon_0 A_0 \cos \varphi \cos \omega t - \epsilon_0 A_0 \sin \varphi \sin \omega t \quad \begin{cases} \times \cos \omega t \\ \times \sin \omega t \end{cases}$$

$$F_1 = A_0 \frac{1}{2} \cos \varphi, \quad F_2 = A_0 \frac{1}{2} \sin \varphi, \quad \varphi = \arctg \frac{F_2}{F_1}$$