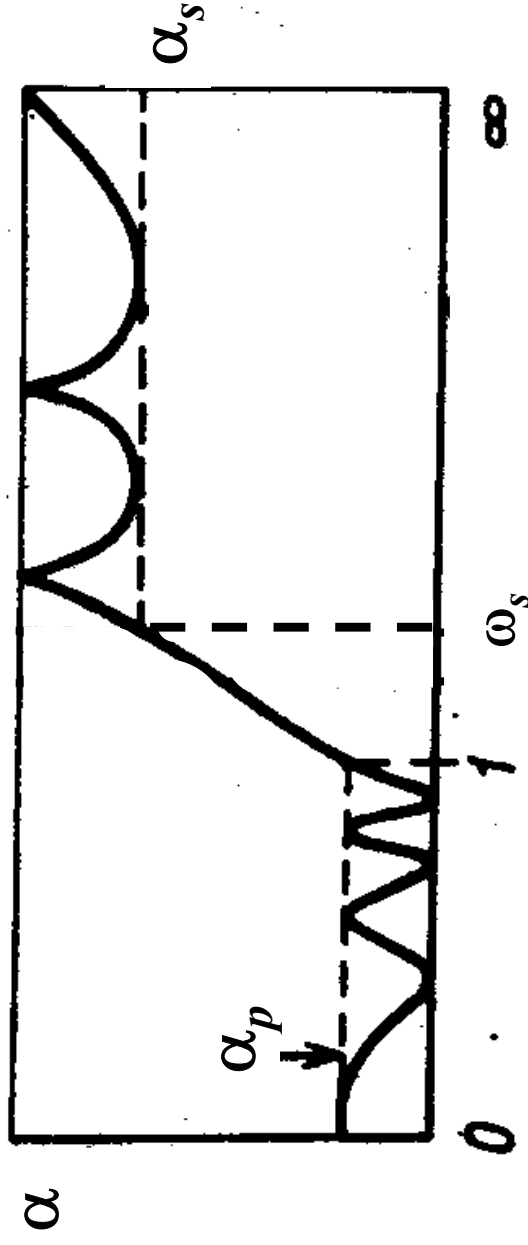


Filtry eliptyczne **(filtry Cauera)**

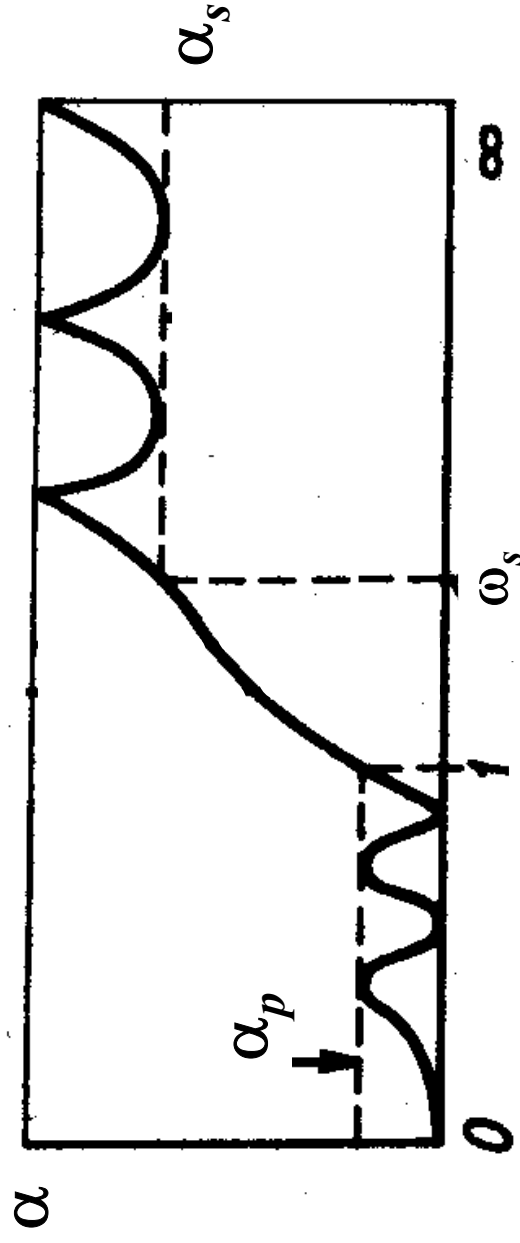
Charakterystyka amplitudowa



Rząd filtru

parzysty

$n = 6$



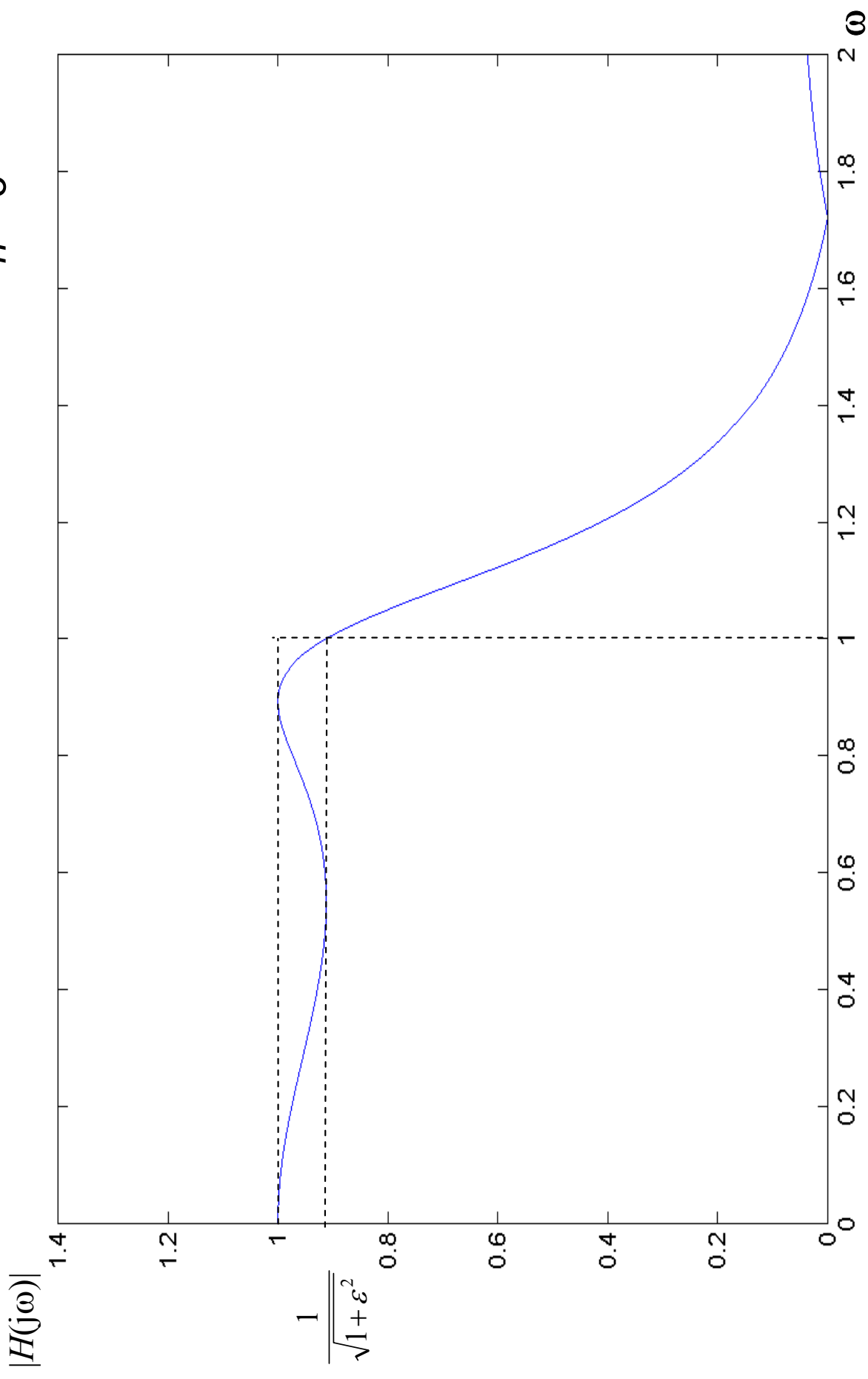
Rząd filtru

nieparzysty

$n = 5$

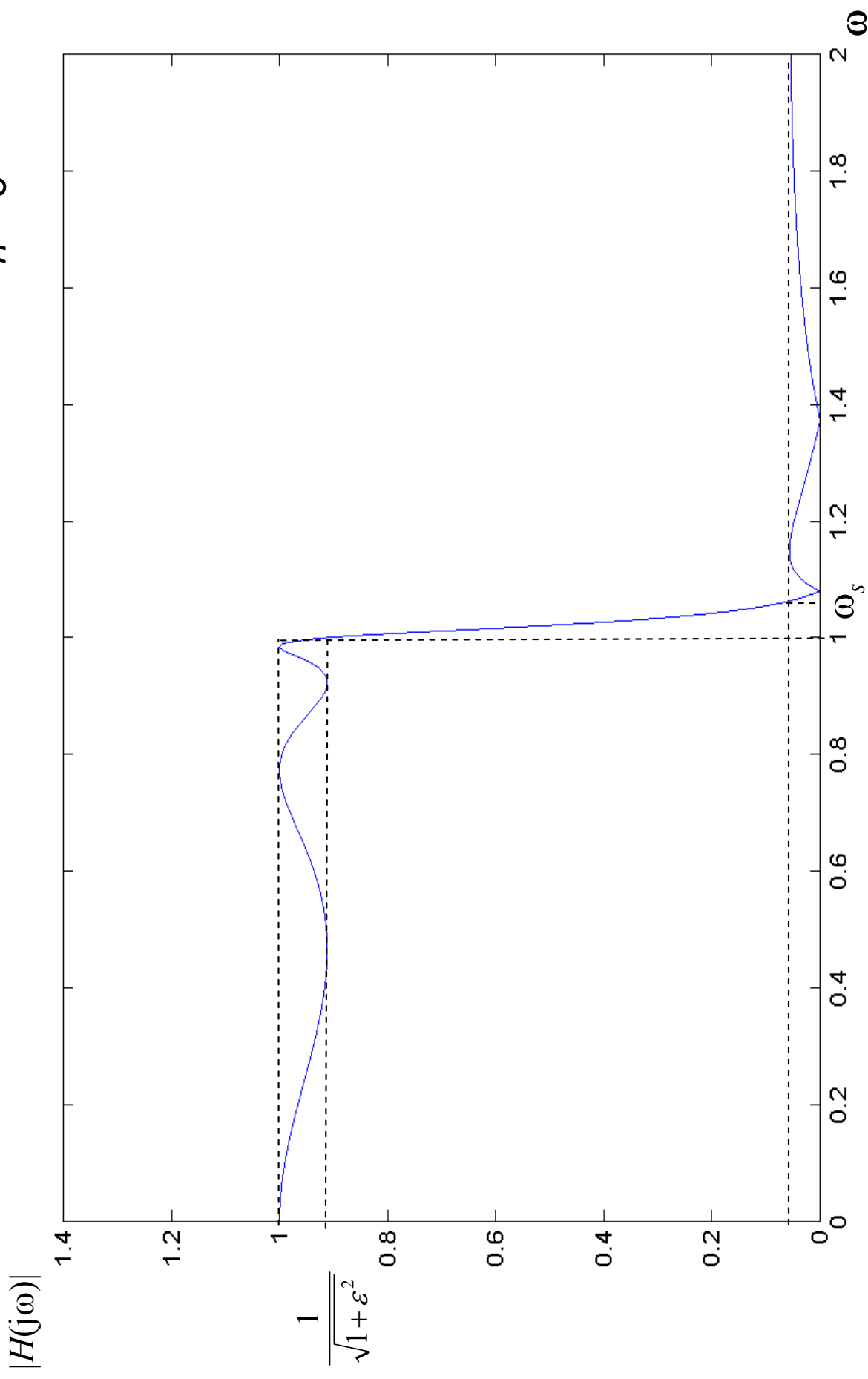
Charakterystyka amplitudowa

$n = 3$



Charakterystyka amplitudowa

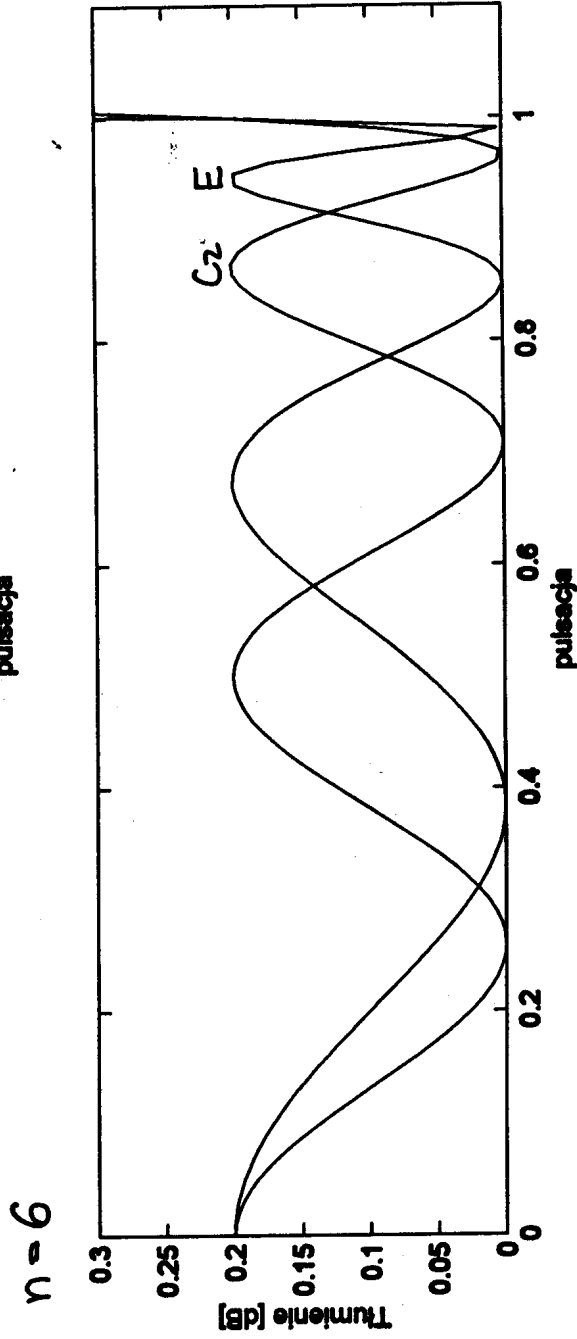
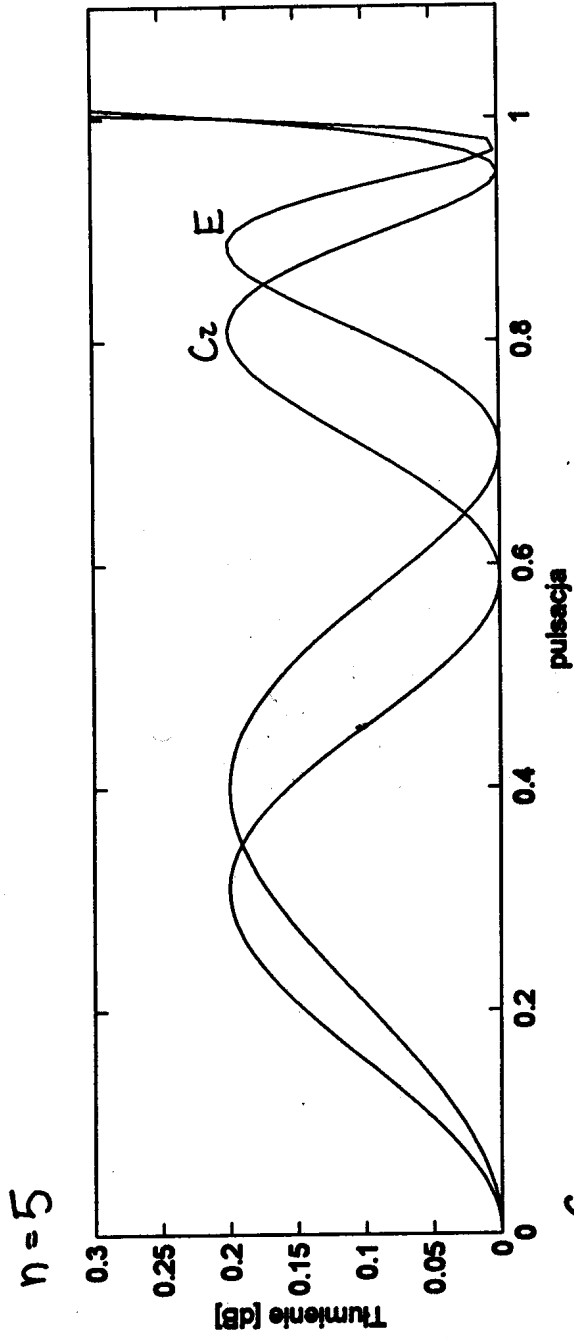
$n = 5$



Pasma przepustowe, $\alpha_p = 0,20 \text{ dB}$

E - filtr eliptyczny $\alpha_s = 30 \text{ dB}$

Cz - filtr Czebyszewa

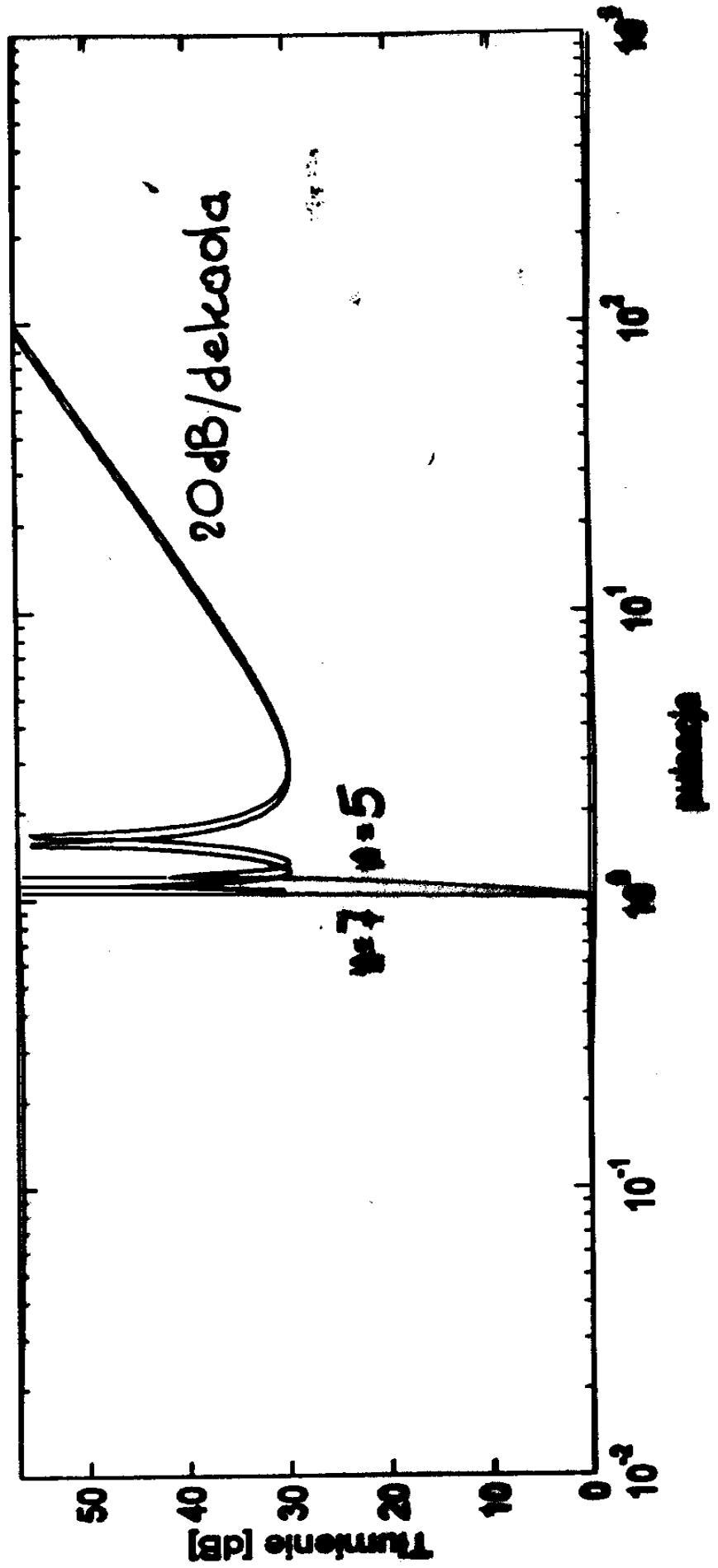


Filtary eliptyczne

$$n = 5,7$$

$$\alpha_p = 0,2 \text{ dB}$$

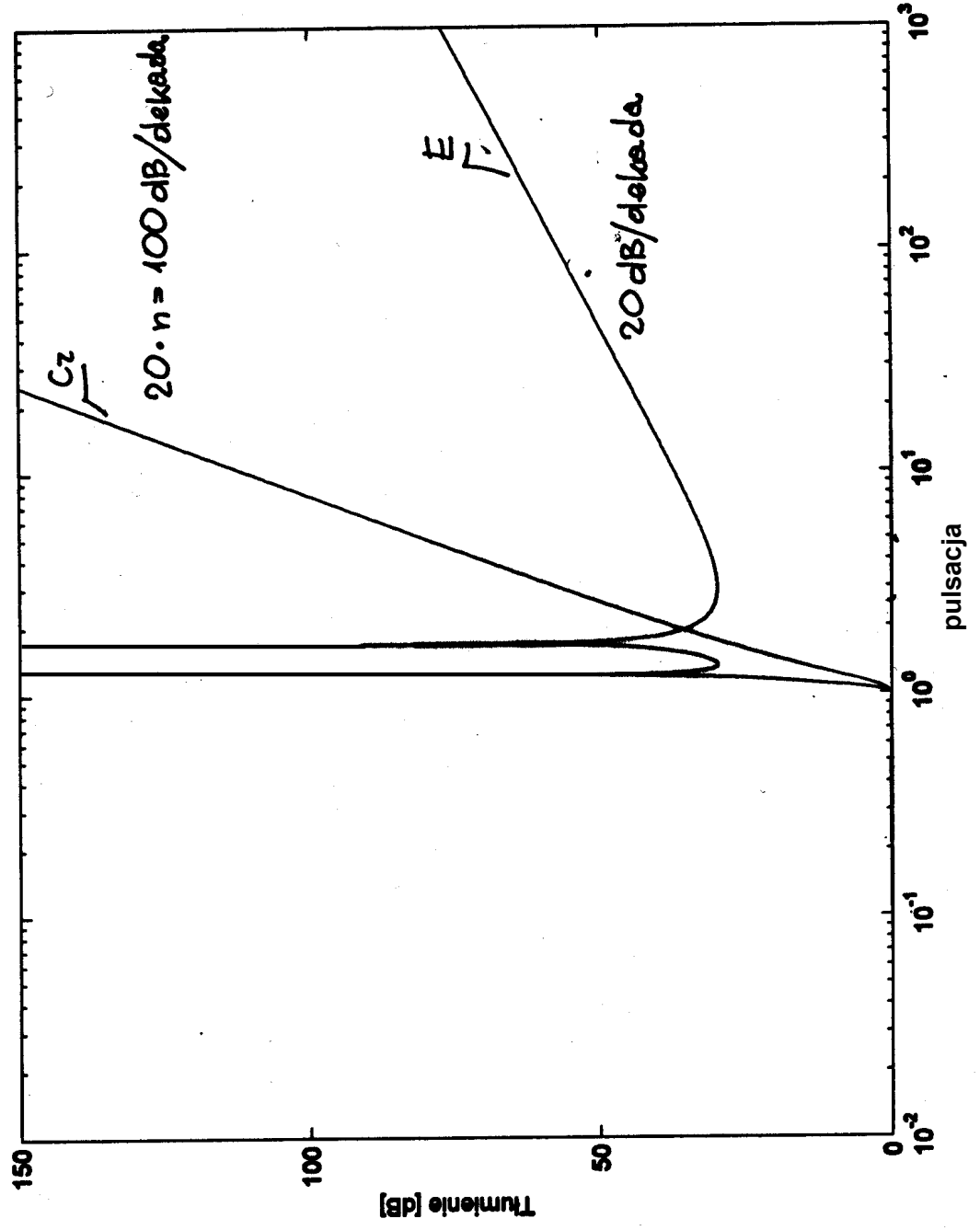
$$\alpha_s = 20 \text{ dB}$$



Filtry pigtego rzędu

$n=5, \omega_p = 0,20 \text{ dB}$

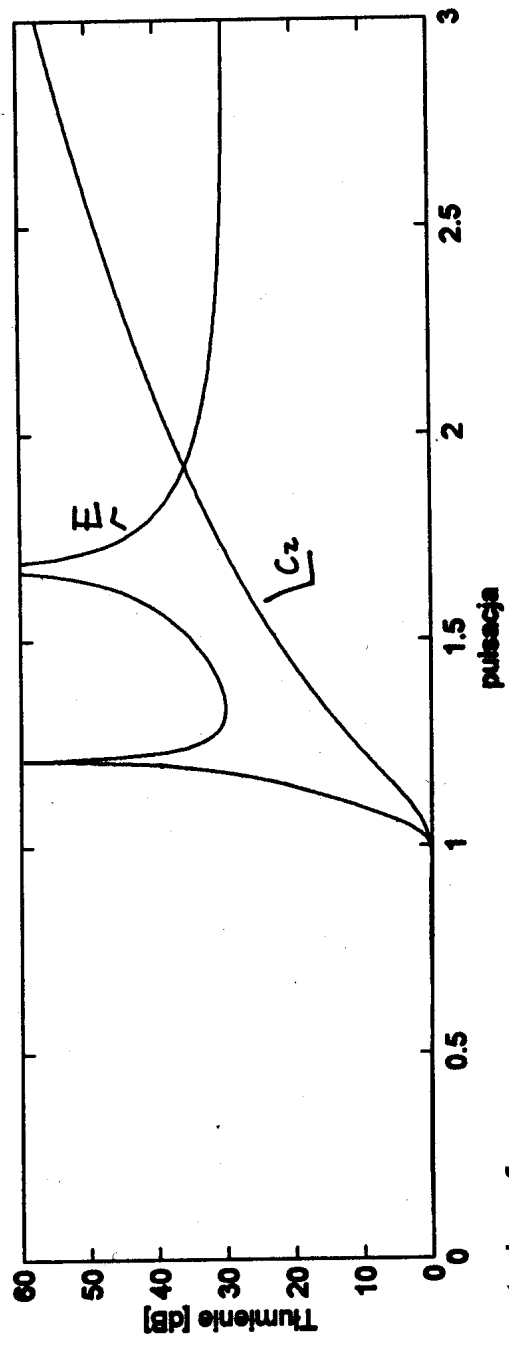
- 1) Eliptyczny $\nu_s = 30 \text{ dB}$ E
- 2) Czebyszewa Cz



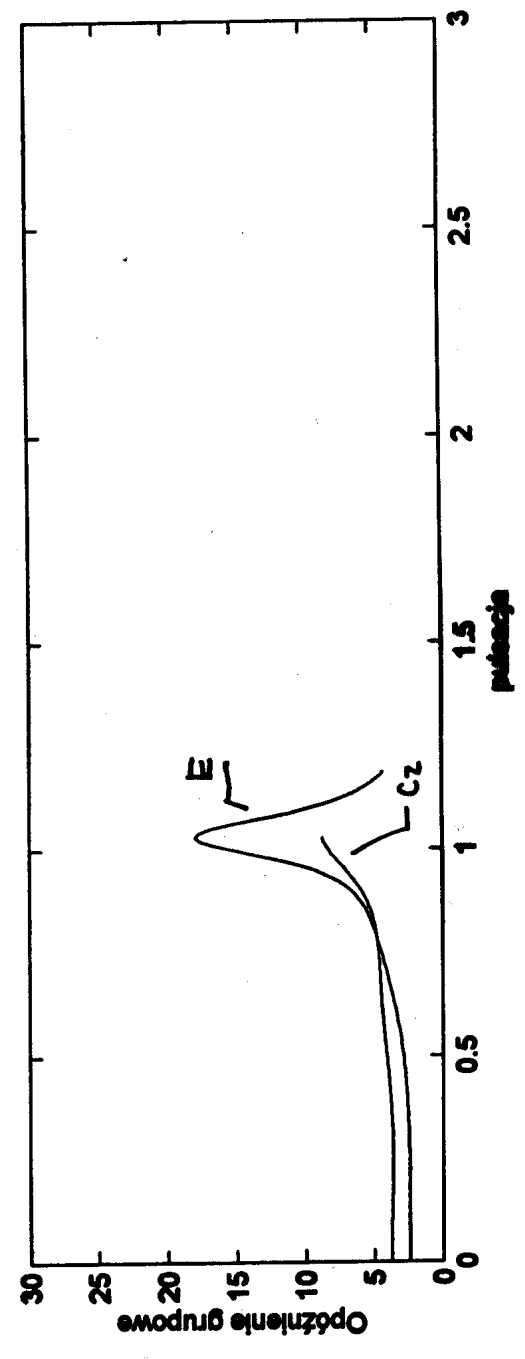
Filtry piętogo rzędu ($n=5$)
 $\alpha_p = 0,20 \text{ dB}$

- 1) Eliptyczny $\alpha_s = 30 \text{ dB}$ (E)
- 2) Czebyszewa (Cz)

Charakterystyka amplitudowa



Charakterystyka fazowa

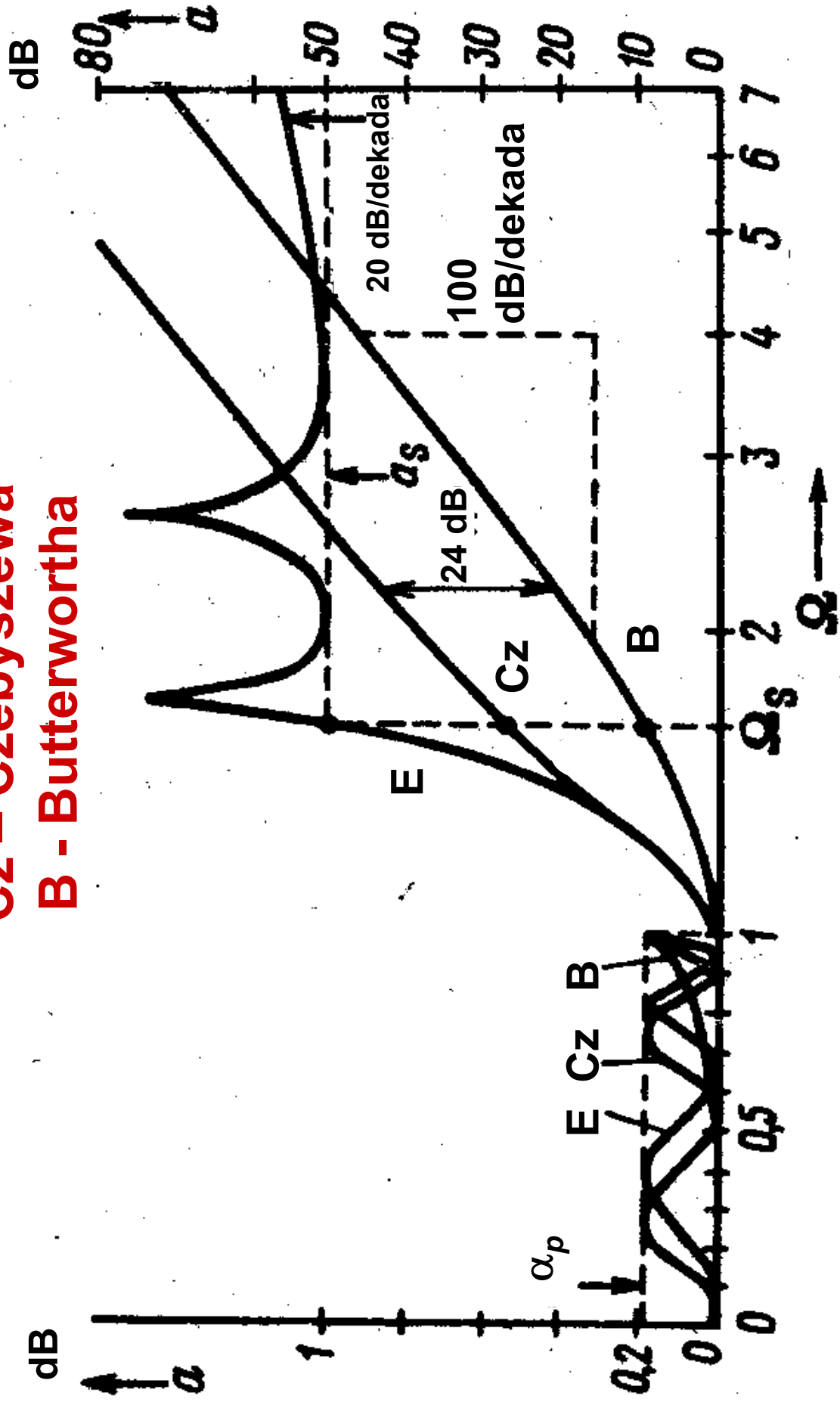


Porównanie typów filtrów $n = 5$

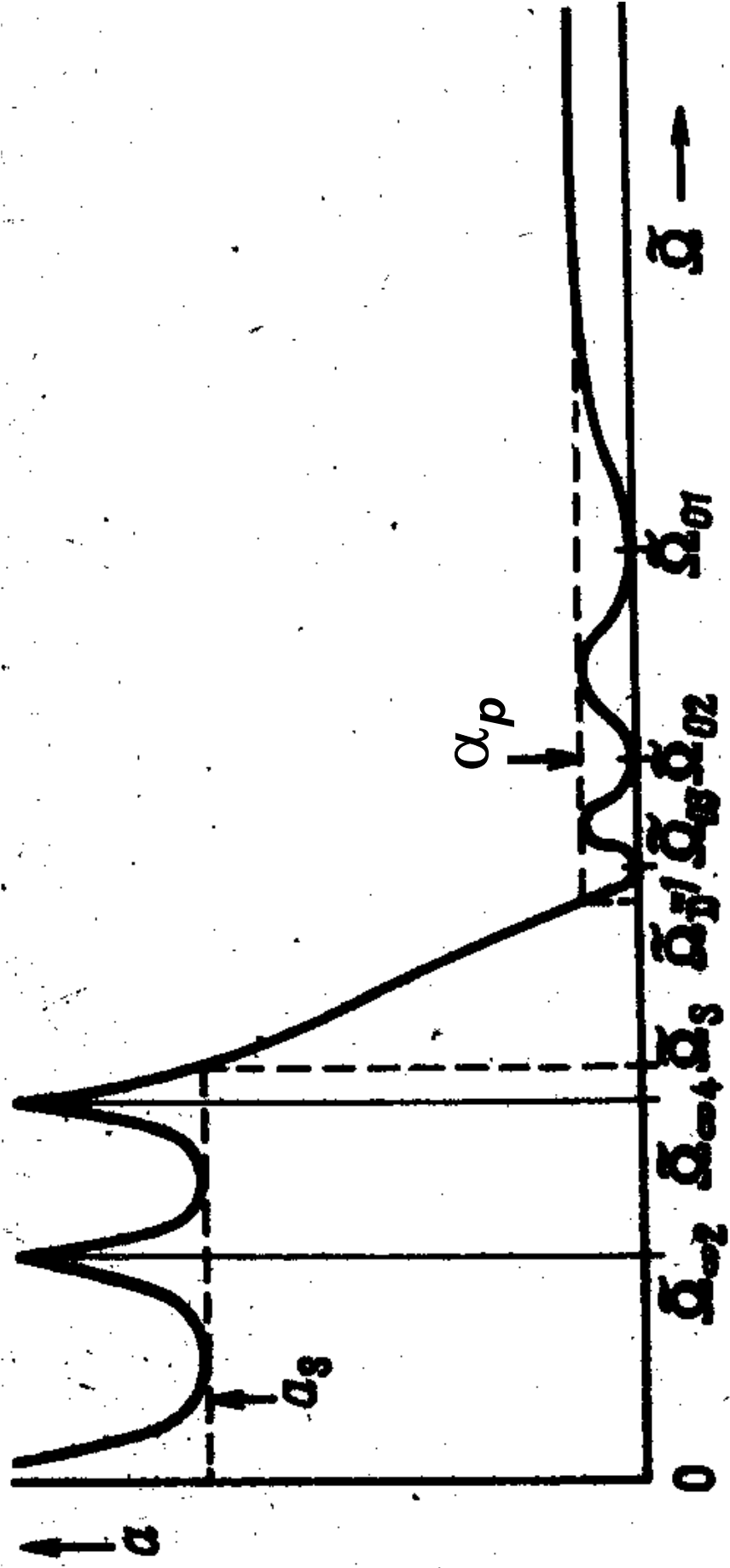
E – eliptyczny (Cauera)

Cz – Czebyszewa

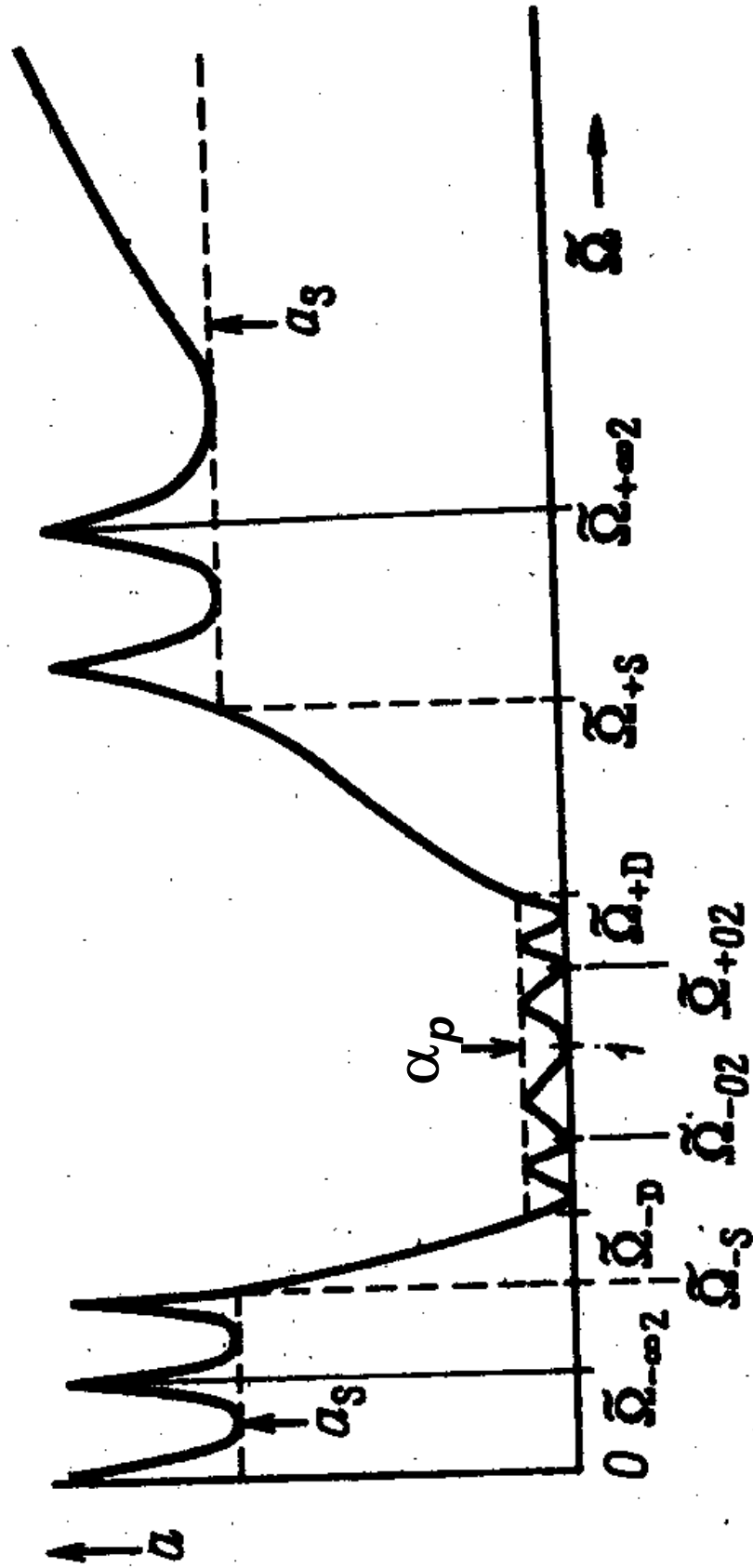
B - Butterwortha



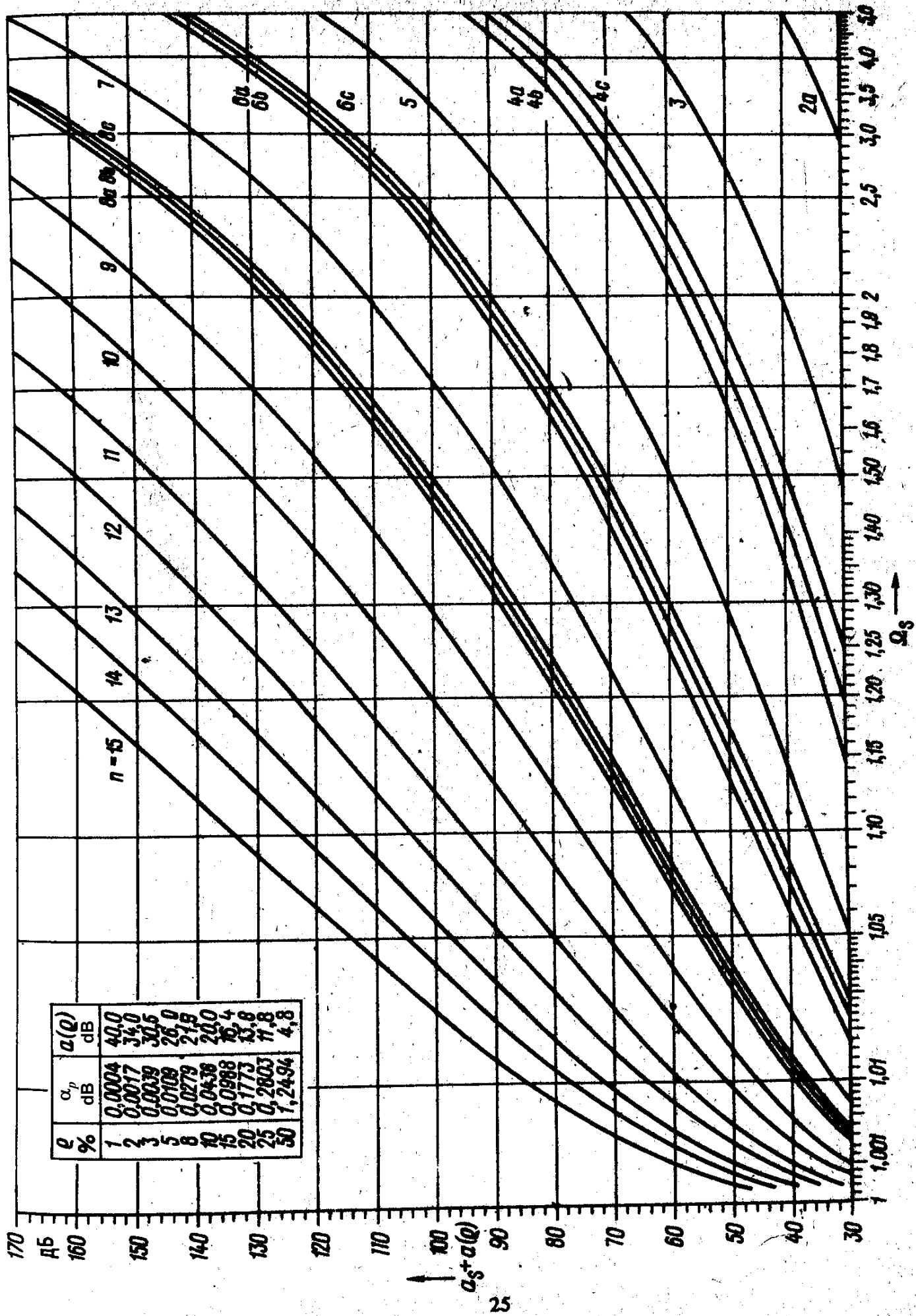
Filtr górnoprzepustowy



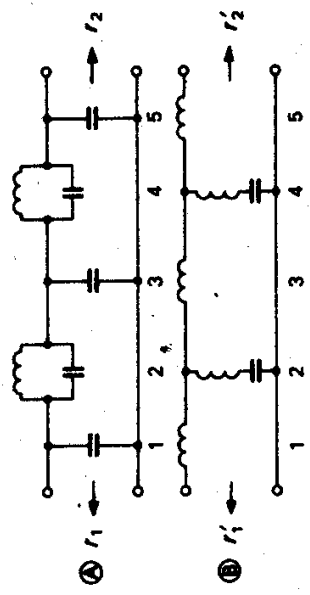
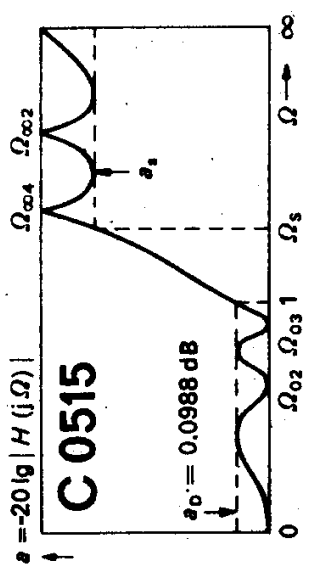
Filtr pasmowoprzepustowy



Nomogram dla filtrów eliptycznych



Tablice filtrów



$$1/H = C \frac{(\rho - \alpha_1) \prod_{\nu=2}^3 (\rho^2 - 2\alpha_\nu \rho + \gamma_\nu)}{\prod_{\nu=1}^2 (\rho^2 + \Omega_{\infty 2\nu}^2)}$$

$$\gamma_\nu = \alpha_\nu^2 + \beta_\nu^2$$

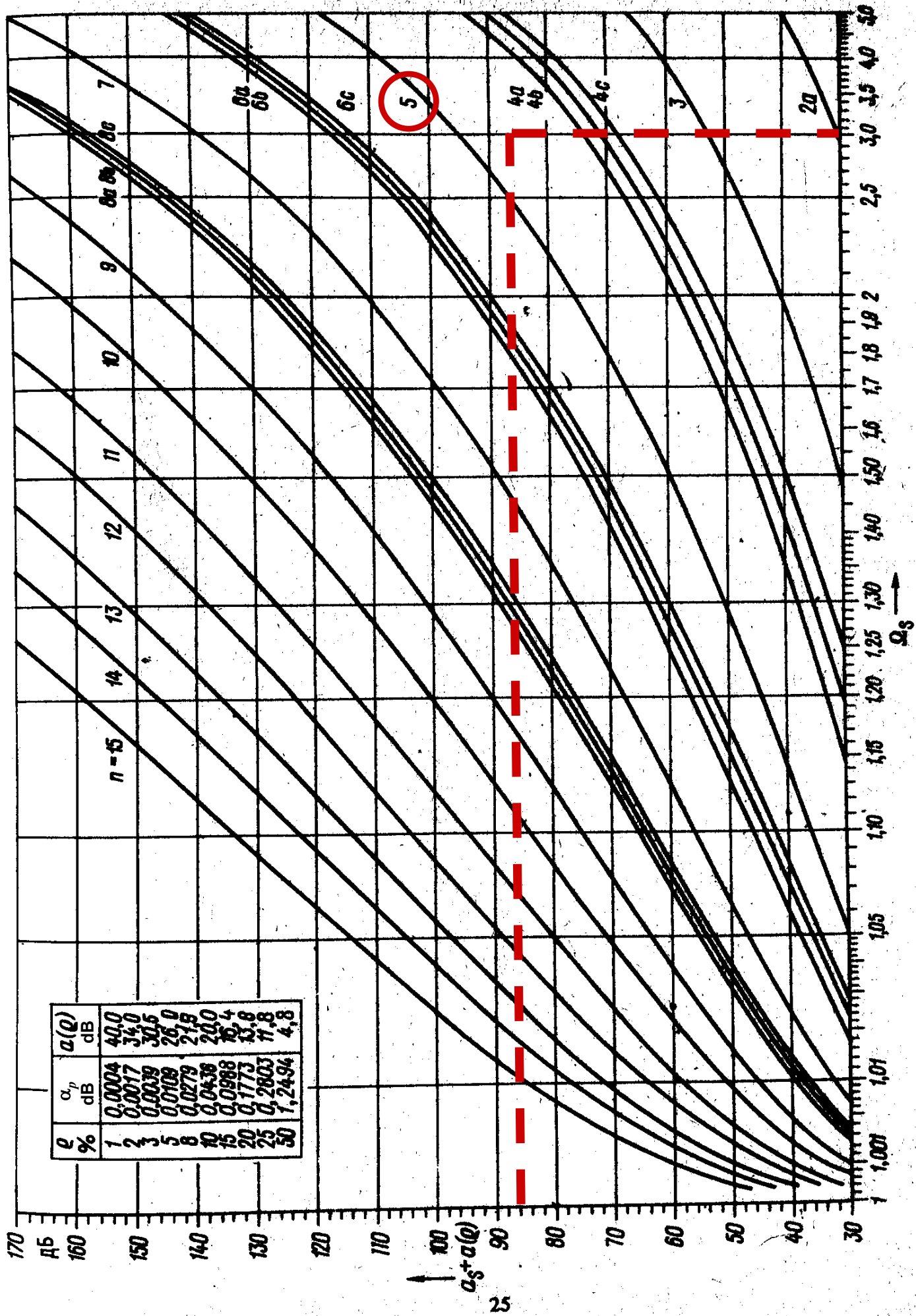
θ	Ω _s	α _s dB	r ₁ = 1		r ₂ = 1		Ω _{∞2ν}	Ω _{0ν}	-α _ν	±β _ν	C
			C _{2ν-1}	L _{2ν}	C _{2ν}	L _{2ν}					
P	1	4.23857	1.09841	1.162063	1.09841	1.162063	0.0000000000	0.0000000000	1.4581205301	0.0000000000	0.151716821
	2	1.371629	0.94772	0.613411	0.94772	0.613411	0.0000000000	0.0000000000	1.1786442887	0.8570617436	
	3	0.423857	0.211928	0.11928	0.211928	0.11928	0.0000000000	0.0000000000	0.4568640236	1.3867660317	
T	1	1.143980	1.374943	1.591557	1.374943	1.591557	0.0000000000	0.0000000000	0.5402488986	0.0000000000	2.427464340
	2	1.972209	1.964653	1.247452	1.964653	1.247452	0.5877852523	0.5877852523	0.4370705408	0.6880791260	
	3	1.143980	0.571890	0.571890	0.571890	0.571890	0.9510665163	0.9510665163	0.1669460912	1.0609747330	
16	1	3.627895278	1.367802	1.574318	1.367802	1.574318	0.0000000000	0.0000000000	0.5841846138	0.0000000000	1.244.254423782
	2	1.918975	1.615051	1.161248	1.615051	1.161248	0.8583898406	0.8583898406	0.4354211551	0.683289209	
	3	1.095636	0.518447	0.518447	0.518447	0.518447	0.9528274037	0.9528274037	0.1569306952	1.0781317151	
17	1	3.420303620	1.366886	1.572082	1.366886	1.572082	0.0000000000	0.0000000000	0.560306714	0.0000000000	972.985280787
	2	1.913178	1.610078	1.160169	1.610078	1.160169	0.5983601341	0.5983601341	0.4354058787	0.684889828	
	3	1.089628	0.509186	0.509186	0.509186	0.509186	0.9530657205	0.9530657205	0.1579046234	1.0788932579	
18	1	3.236067978	1.348012	1.569708	1.348012	1.569708	0.0000000000	0.0000000000	0.5580011698	0.0000000000	771.3123652195
	2	1.908087	1.604838	1.158432	1.604838	1.158432	0.5874136324	0.5874136324	0.4351704283	0.6848338023	
	3	1.083043	0.501458	0.501458	0.501458	0.501458	0.9532878808	0.9532878808	0.1568160692	1.0786328272	
19	1	3.071553467	1.340664	1.567190	1.340664	1.567190	0.0000000000	0.0000000000	0.5600867277	0.0000000000	618.812070468
	2	1.898804	1.498239	1.126035	1.498239	1.126035	0.5985308252	0.5985308252	0.4348132115	0.6881226403	
	3	1.076078	0.493256	0.493256	0.493256	0.493256	0.9535638841	0.9535638841	0.1568716288	1.0783558786	
20	1	2.923804400	1.337298	1.564531	1.337298	1.564531	0.0000000000	0.0000000000	0.5623259501	0.0000000000	502.053825632
	2	1.890733	1.483587	1.112861	1.483587	1.112861	0.5987121149	0.5987121149	0.4346325585	0.6914378857	
	3	1.068737	0.484578	0.484578	0.484578	0.484578	0.9538373302	0.9538373302	0.1544854925	1.0786613863	
21	1	2.790428110	1.115425	1.362738	1.115425	1.362738	0.0000000000	0.0000000000	0.5646856438	0.0000000000	411.266101867
	2	1.882478	1.256818	1.098273	1.256818	1.098273	0.602888270	0.602888270	0.434371307	0.6938808280	
	3	1.061017	0.475415	0.475415	0.475415	0.475415	0.9541074174	0.9541074174	0.1532000667	1.0777486050	
22	1	2.689467163	1.112596	1.361528	1.112596	1.361528	0.0000000000	0.0000000000	0.5671809212	0.0000000000	339.882163187
	2	1.873835	1.247920	1.02431	1.247920	1.02431	0.6022708564	0.6022708564	0.4338951093	0.6964522415	
	3	1.052918	0.465758	0.465758	0.465758	0.465758	0.9540048445	0.9540048445	0.1518757525	1.0774200528	
23	1	2.659304665	1.109627	1.356666	1.109627	1.356666	0.0000000000	0.0000000000	0.5698147173	0.0000000000	283.173688578
	2	1.864813	1.236531	1.04802	1.236531	1.04802	0.603846379	0.603846379	0.4339808280	0.6891540957	
	3	1.044440	0.456802	0.456802	0.456802	0.456802	0.9547630980	0.9547630980	0.1504829788	1.0770723534	
24	1	2.465859336	1.108515	1.322015	1.108515	1.322015	0.0000000000	0.0000000000	0.5725808012	0.0000000000	237.667607838
	2	1.854414	1.224665	1.054247	1.224665	1.054247	0.6050954567	0.6050954567	0.4332437343	0.7019876342	
	3	1.035562	0.444836	0.444836	0.444836	0.444836	0.9550415076	0.9550415076	0.1480521989	1.0787061373	

θ	Ω _s	α _s dB	r ₁ = 1		r ₂ = 1		Ω _{∞2ν}	Ω _{0ν}	-α _ν	±β _ν	C
			L _{2ν-1}	C _{2ν}	L _{2ν}	C _{2ν}					
⊕			L _{2ν-1}	C _{2ν}	L _{2ν}	C _{2ν}					
			r ₁ ' = 0		r ₂ ' = 1						

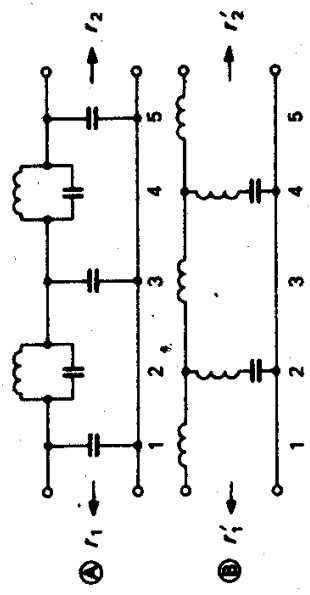
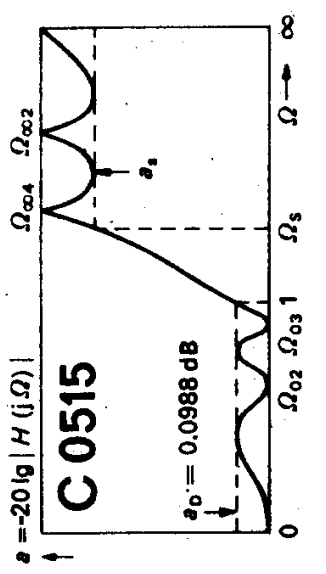
Przykład

$$\alpha_p = 0,0988 \text{ dB}, \alpha_s = 70 \text{ dB}, \Omega_s = 3$$

Nomogram dla filtrów eliptycznych



Tablice filtrów



$$1/H = C \frac{(\rho - \alpha_1) \prod_{\nu=2}^3 (\rho^2 - 2\alpha_\nu \rho + \gamma_\nu)}{\prod_{\nu=1}^2 (\rho^2 + \Omega_{\infty 2\nu}^2)}$$

$$\gamma_\nu = \alpha_\nu^2 + \beta_\nu^2$$

θ	Ωs	αs dB	r1 = 1		r2 = 1		Ω∞2ν	Ω0ν	-αν	±βν	C
			C2ν-1	l2ν	C2ν	l2ν					
P	1	0.42387	1.19871	1.19871	1.19871	1.19871	0.0000000000	0.0000000000	1.4581205301	0.0000000000	0.151716821
	2	1.371629	1.109671	0.613411	0.613411	0.613411	0.0000000000	0.0000000000	1.1786442887	0.8570617436	
	3	0.42387	1.109671	0.211928	0.211928	0.211928	0.0000000000	0.0000000000	0.4568640236	1.3867560317	
T	1	1.143980	1.371502	1.371502	1.371502	1.371502	0.0000000000	0.0000000000	0.5402488998	0.0000000000	2.427464340
	2	1.972209	1.371502	1.564653	1.247452	1.247452	0.5877852523	0.5877852523	0.4370705408	0.6880791260	
	3	1.143980	1.371502	0.571890	0.571890	0.571890	0.9510665163	0.9510665163	0.1669460912	1.0609747330	
16	1	3.827895278	1.349682	1.349682	0.019953	0.019953	0.0000000000	0.0000000000	0.5841846138	0.0000000000	1.244.254423782
	2	1.918975	1.306891	1.515051	1.161248	0.093389	0.8553894005	0.8553894005	0.4354211551	0.683289209	
	3	1.095638	1.306891	0.518447	0.518447	0.518447	0.9528274037	0.9528274037	0.1569306982	1.0781317151	
17	1	3.420303820	1.346860	1.346860	0.022572	0.022572	0.0000000000	0.0000000000	0.5560306714	0.0000000000	972.985280787
	2	1.913178	1.287473	1.510078	1.160169	0.067507	0.5983601341	0.5983601341	0.4354058787	0.6848898288	
	3	1.089628	1.287473	0.098642	0.098642	0.098642	0.9530667205	0.9530667205	0.1879046234	1.0788932679	
18	1	3.238067978	1.343851	1.343851	0.023391	0.023391	0.0000000000	0.0000000000	0.5580011698	0.0000000000	771.3123652195
	2	1.908087	1.288585	1.504838	1.138432	0.070228	0.5874136034	0.5874136034	0.4351704283	0.6848338023	
	3	1.083043	1.288585	0.067347	0.067347	0.067347	0.9532878808	0.9532878808	0.1868160682	1.0788328722	
19	1	3.071553487	1.340664	1.340664	0.028323	0.028323	0.0000000000	0.0000000000	0.5600867277	0.0000000000	618.812076468
	2	1.898804	1.278138	1.498339	1.126035	0.085580	0.5985308252	0.5985308252	0.4348131215	0.6881226403	
	3	1.076078	1.278138	0.493258	0.493258	0.493258	0.9535638841	0.9535638841	0.1856716288	1.0783558785	
20	1	2.923804400	1.337298	1.337298	0.031469	0.031469	0.0000000000	0.0000000000	0.5623259581	0.0000000000	502.053825632
	2	1.890733	1.289226	1.493587	1.112861	0.098821	0.5987121149	0.5987121149	0.4346325585	0.6914378857	
	3	1.068737	1.289226	0.089850	0.089850	0.089850	0.9538237302	0.9538237302	0.1544854925	1.0786613863	
21	1	2.790428110	1.115425	1.115425	0.034775	0.034775	0.0000000000	0.0000000000	0.5648656438	0.0000000000	411.266101867
	2	1.882478	1.258618	1.487591	1.098273	0.106352	0.600888270	0.600888270	0.434371307	0.6938808280	
	3	1.081017	1.258618	0.475415	0.475415	0.475415	0.9541074174	0.9541074174	0.1532000667	1.0777486050	
22	1	2.689467183	1.112596	1.112596	0.038271	0.038271	0.0000000000	0.0000000000	0.5671809212	0.0000000000	339.882163187
	2	1.873835	1.247920	1.481360	1.084912	0.117821	0.6022708564	0.6022708564	0.4338951093	0.6964522415	
	3	1.052918	1.247920	0.465758	0.465758	0.465758	0.9544048445	0.9544048445	0.1518757525	1.0774200528	
23	1	2.659304685	1.109627	1.109627	0.041951	0.041951	0.0000000000	0.0000000000	0.56898147173	0.0000000000	283.173688578
	2	1.864813	1.236531	1.474802	1.068902	0.130065	0.6036463376	0.6036463376	0.4338951093	0.6991540957	
	3	1.044440	1.236531	0.456802	0.456802	0.456802	0.9547163080	0.9547163080	0.1504829788	1.0770723534	
24	1	2.465893336	1.108515	1.108515	0.045618	0.045618	0.0000000000	0.0000000000	0.5725808012	0.0000000000	237.867607838
	2	1.854414	1.224665	1.468229	1.054247	0.143126	0.6050954567	0.6050954567	0.4332437343	0.7019876342	
	3	1.035682	1.224665	0.444838	0.444838	0.444838	0.9550415076	0.9550415076	0.1480521989	1.0787061373	

θ	Ωs	αs dB	r1 = 1		r2 = 1		Ω∞2ν	Ω0ν	-αν	±βν	C
			C2ν-1	l2ν	C2ν	l2ν					
Ⓟ	1	0.42387	1.19871	1.19871	1.19871	1.19871	0.0000000000	0.0000000000	1.4581205301	0.0000000000	0.151716821
	2	1.371629	1.109671	0.613411	0.613411	0.613411	0.0000000000	0.0000000000	1.1786442887	0.8570617436	
	3	0.42387	1.109671	0.211928	0.211928	0.211928	0.0000000000	0.0000000000	0.4568640236	1.3867560317	