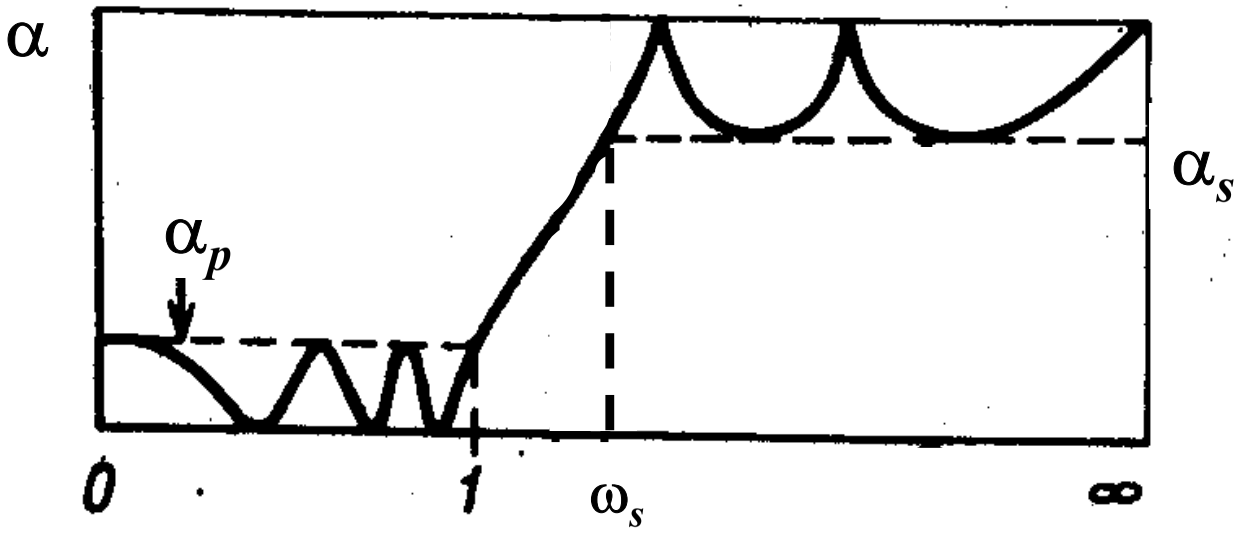
Filtry eliptyczne (filtry Cauera)

Charakterystyka amplitudowa

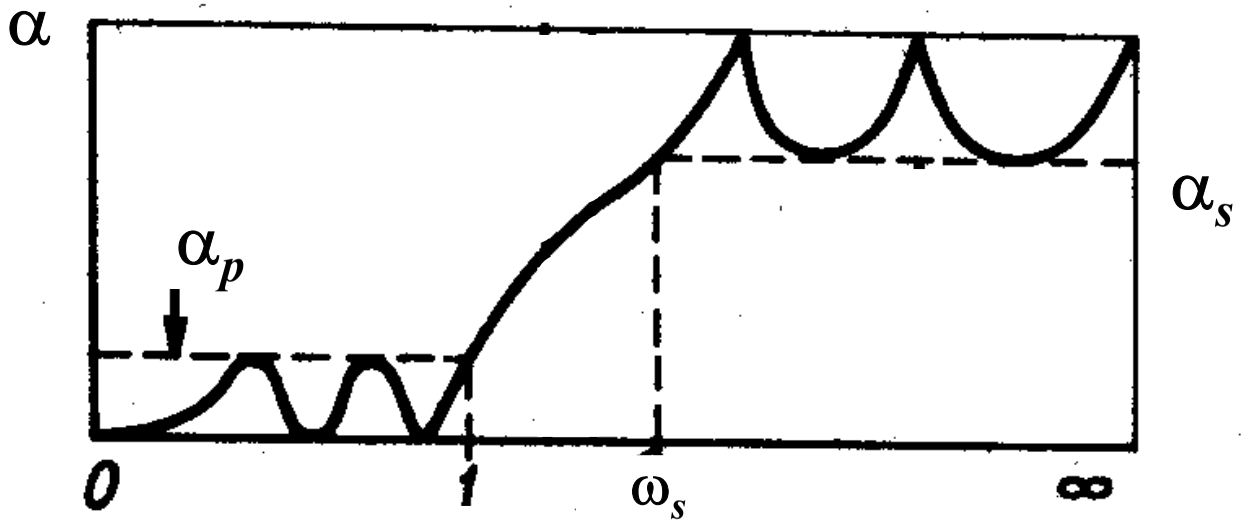
Rząd filtru parzysty

$n = 6$

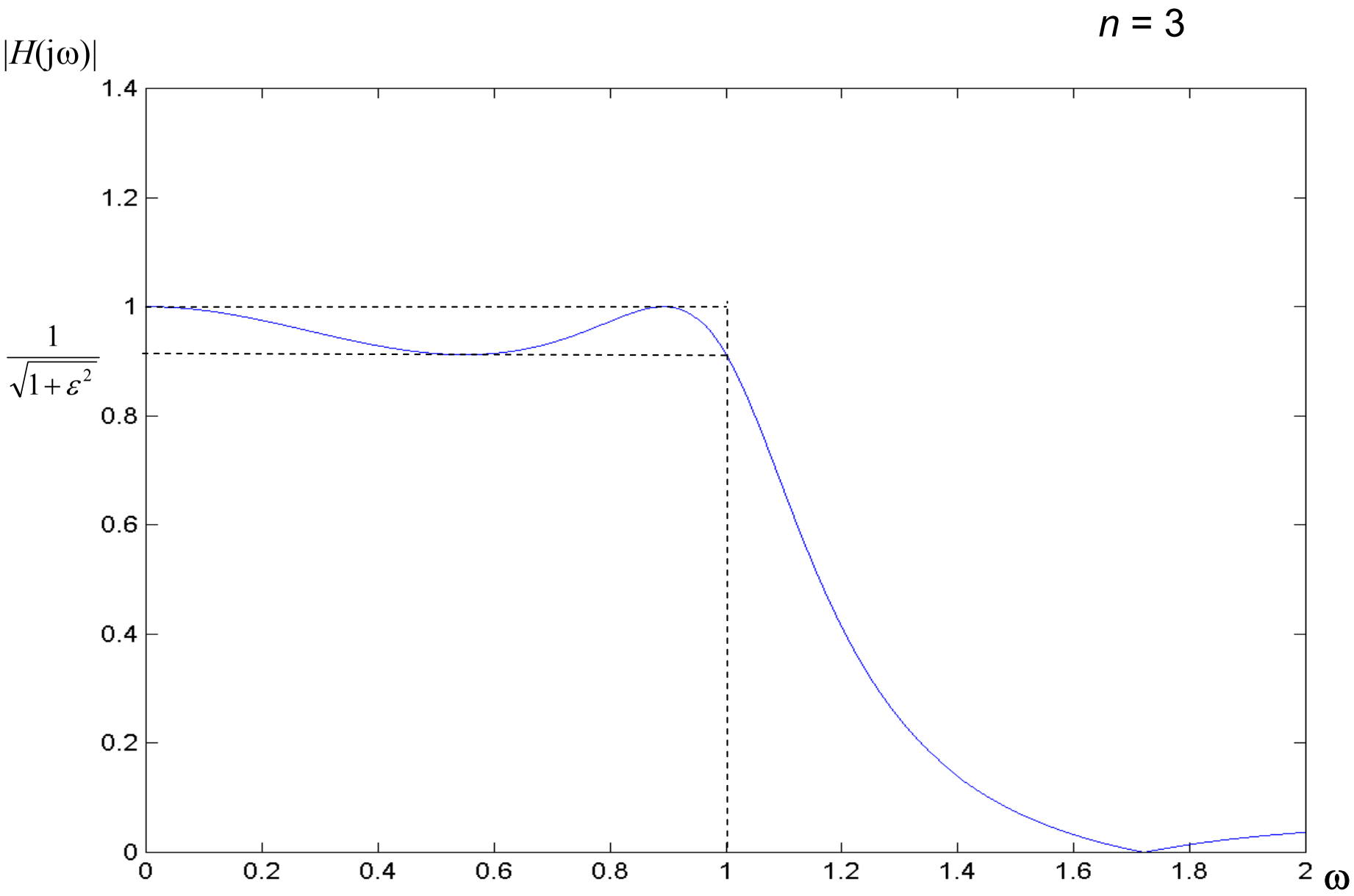


Rząd filtru nieparzysty

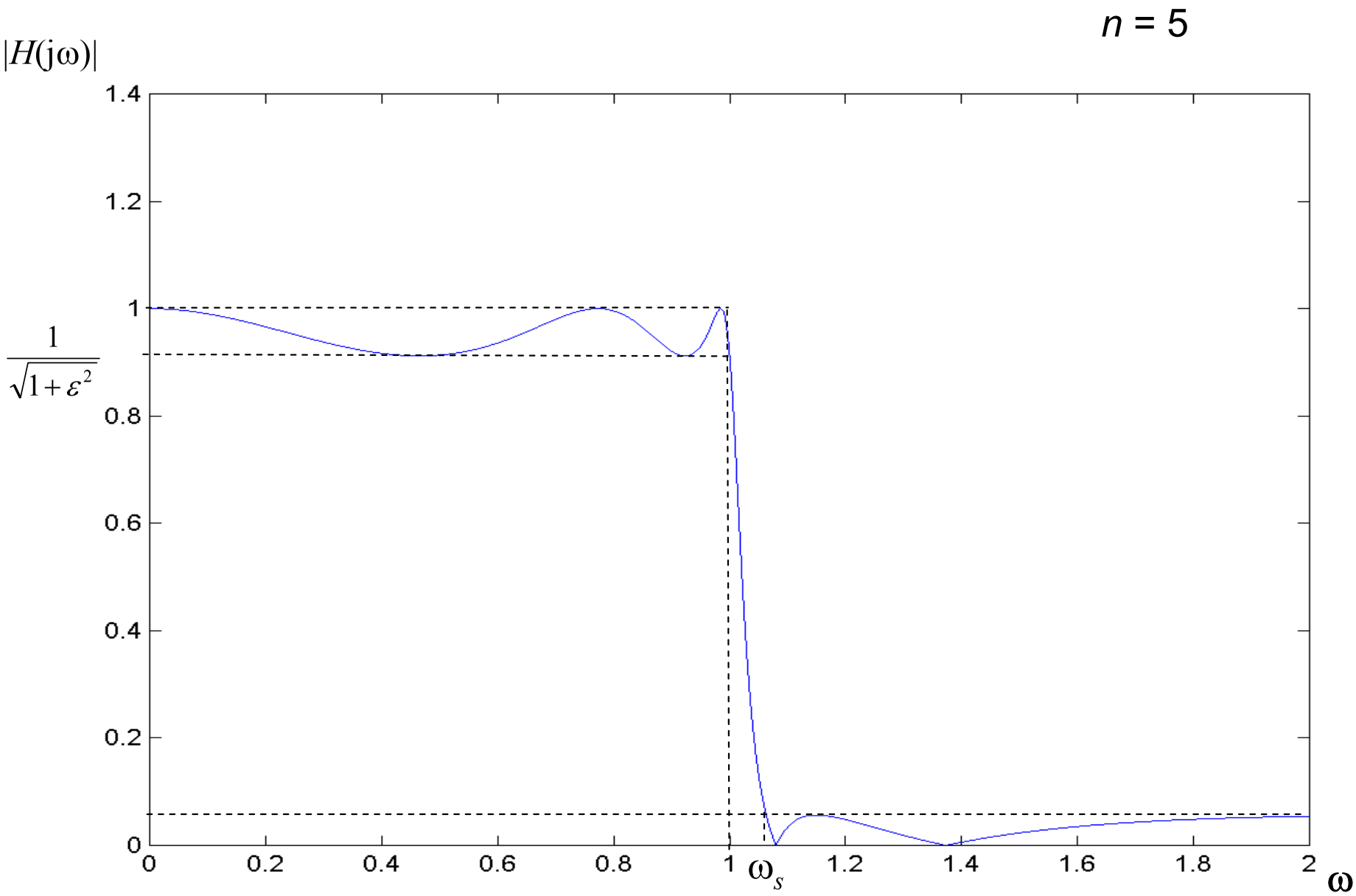
$n = 5$



Charakterystyka amplitudowa



Charakterystyka amplitudowa

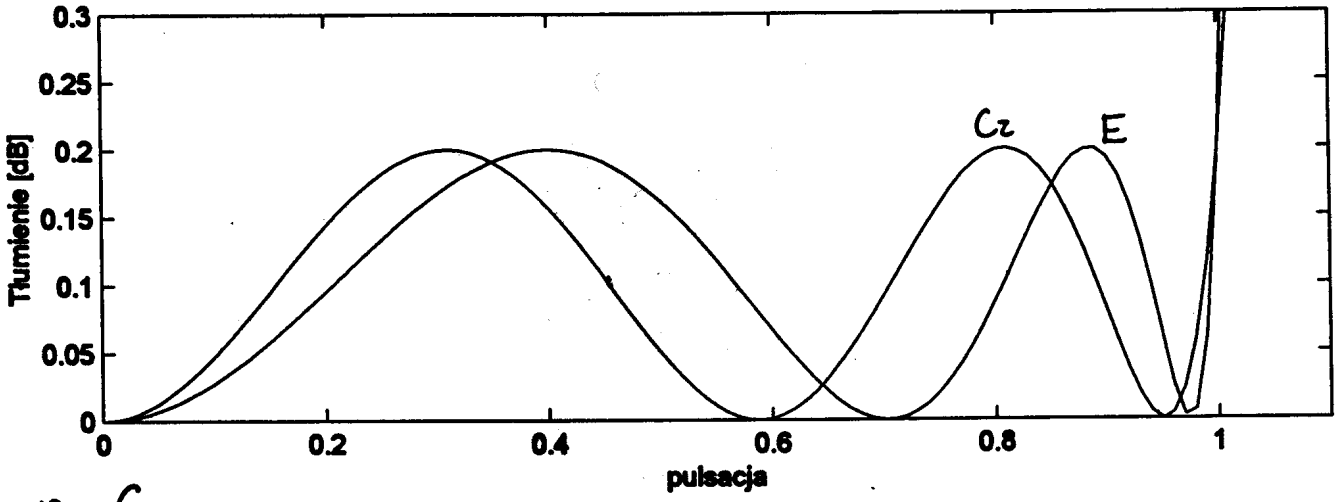


Pasmo przepustowe, $\alpha_p = 0{,}20\,dB$

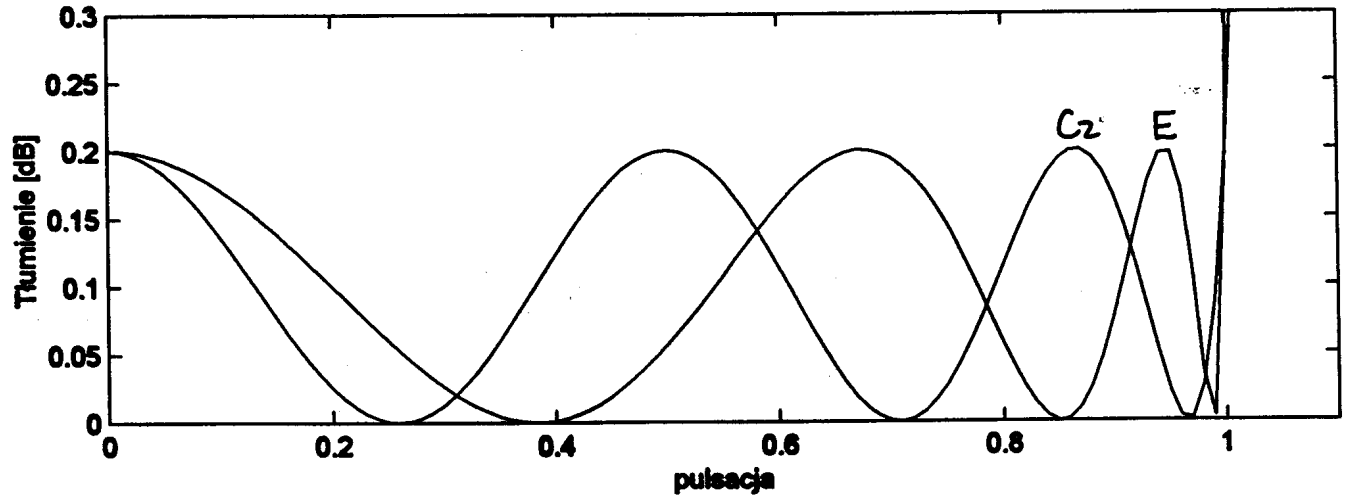
E - filtr eliptyczny $\alpha_s = 30\,dB$

Cz - filtr Czebyszewa

n = 5



n = 6

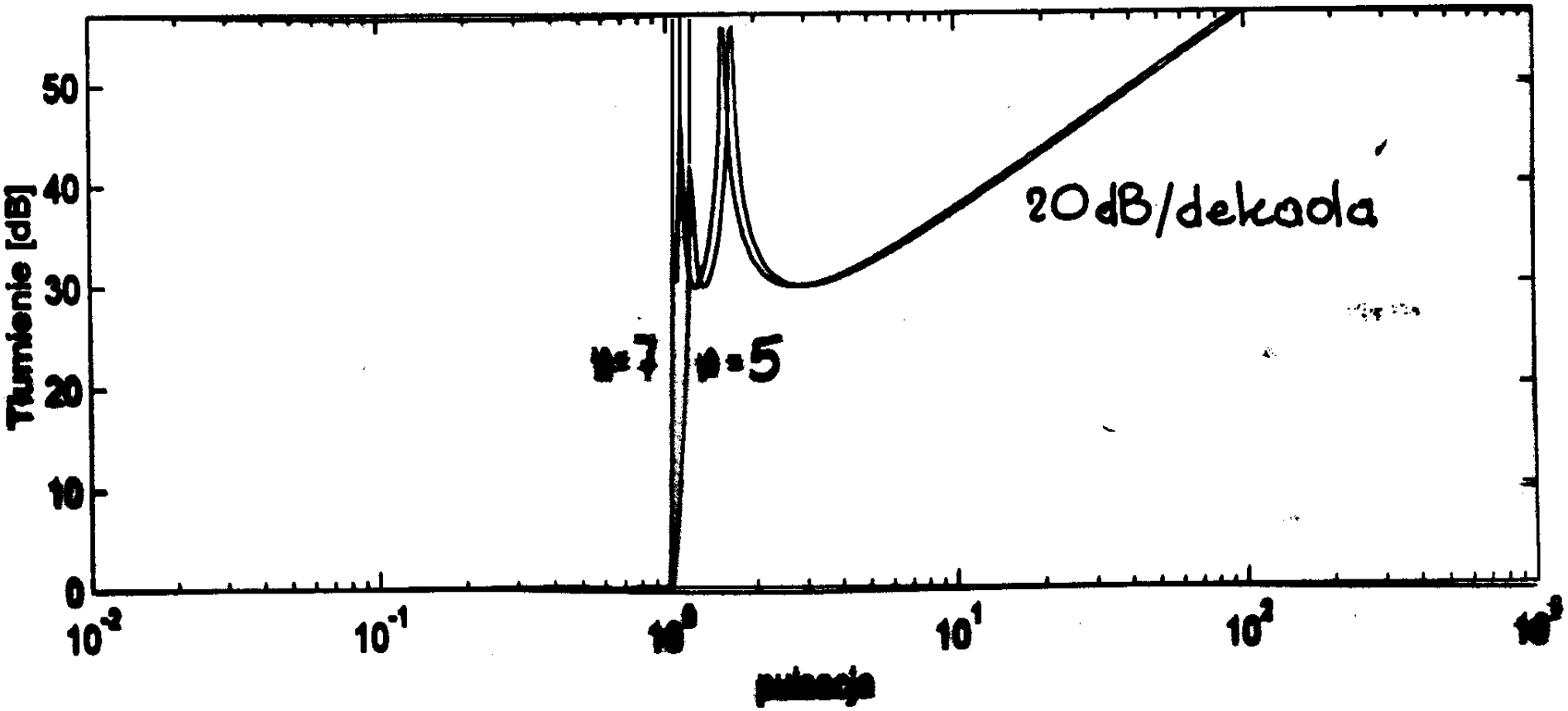


Filtry eliptyczne

$n = 5, 7$

$\alpha_p = 0{,}2$ dB

$\alpha_s = 30$ dB

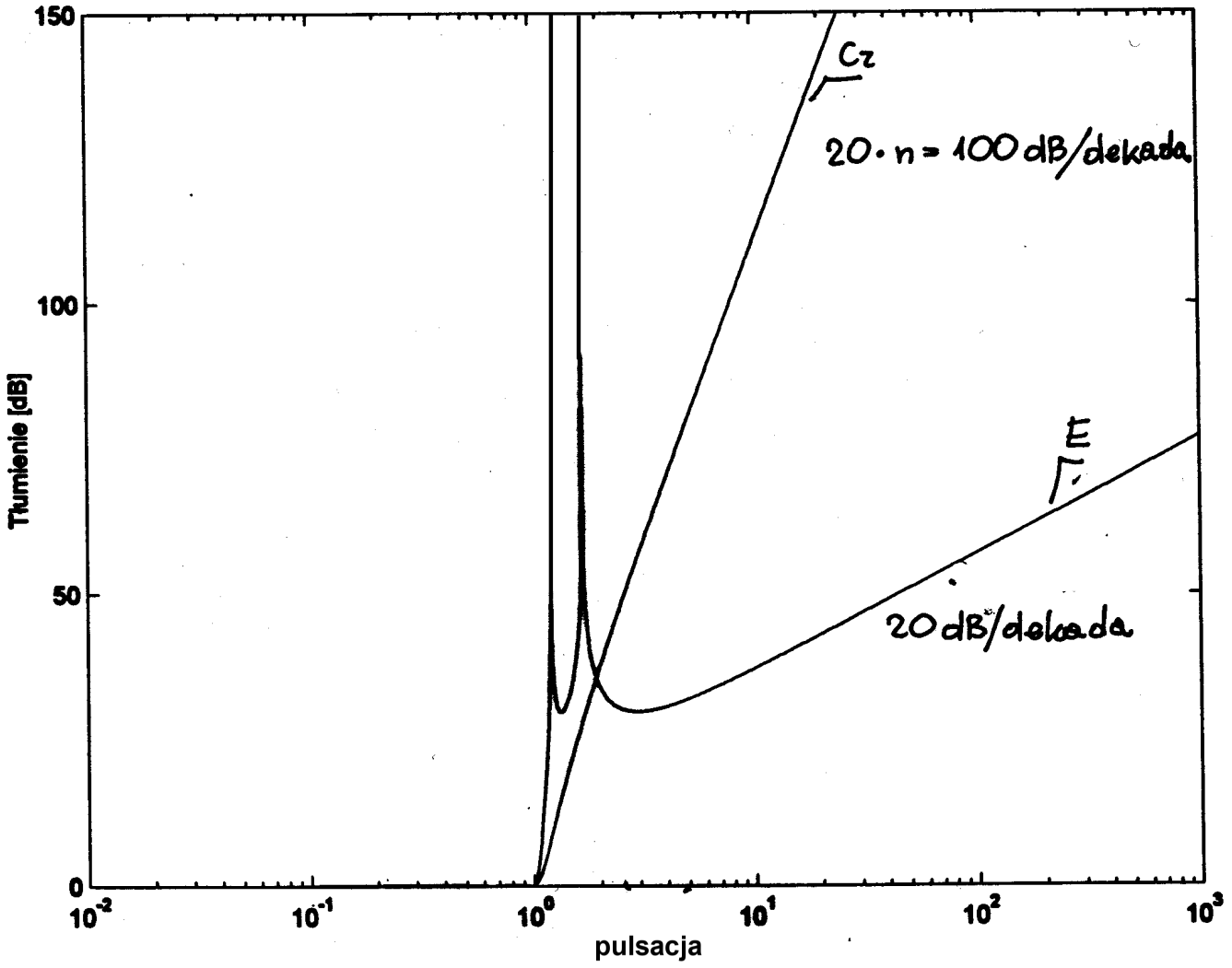


Filtry piątego rzędu

$n=5$, $\alpha_p = 0{,}20\,dB$

1) Eliptyczny $\alpha_s = 30dB$ E

2) Czebyszewa Cz

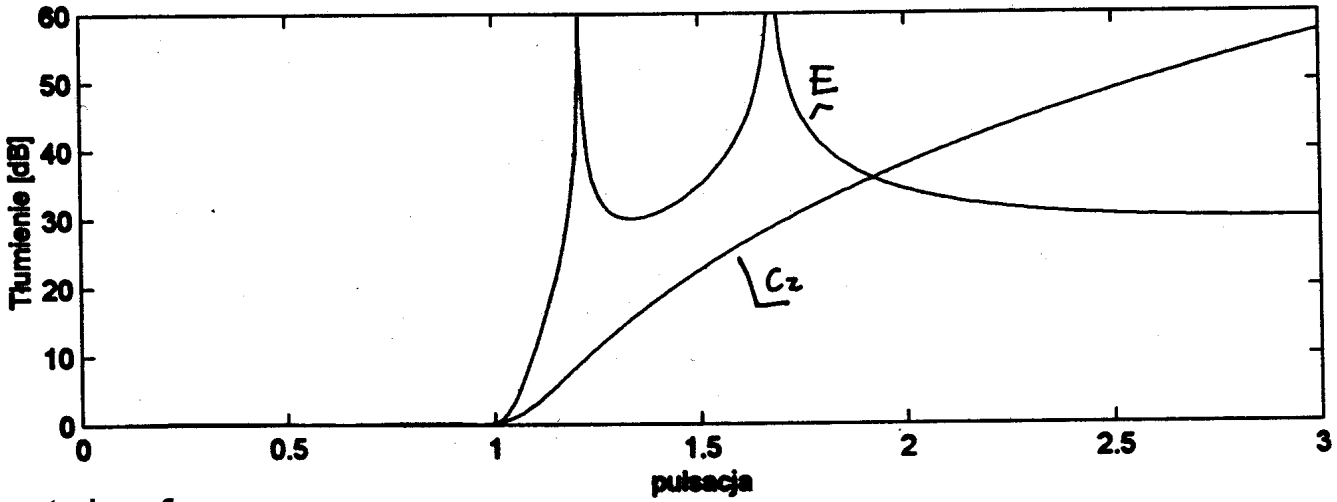


Filtry piątego rzędu (n=5)

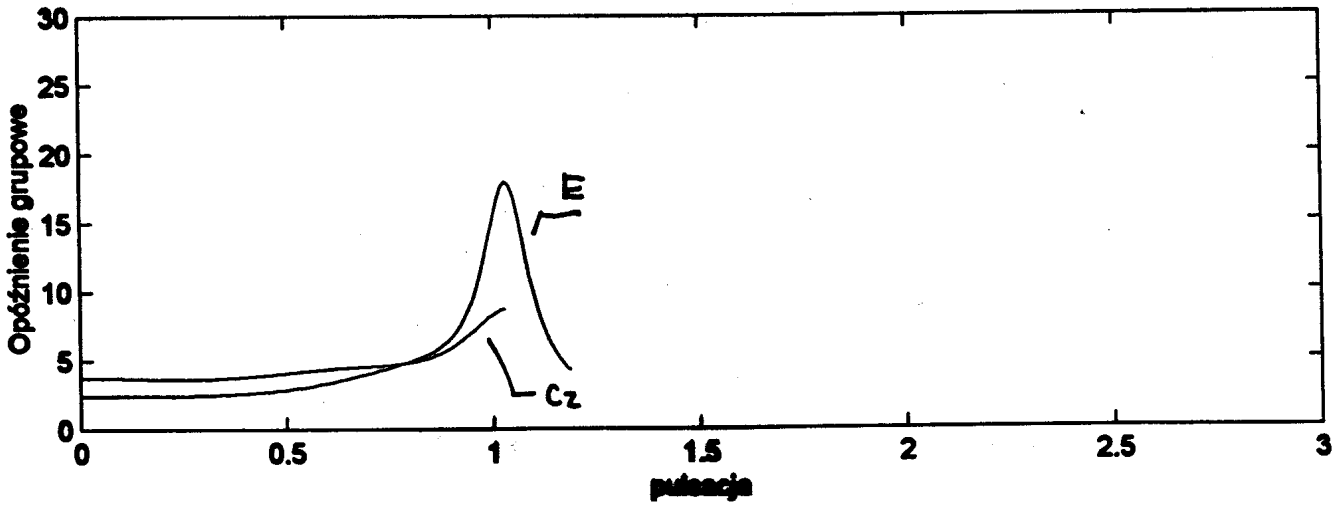
$\alpha_p = 0{,}20\,dB$

1) Eliptyczny $\alpha_s = 30dB$ (E)
2) Czebyszewa (Cz)

Charakterystyka amplitudowa



Charakterystyka fazowa



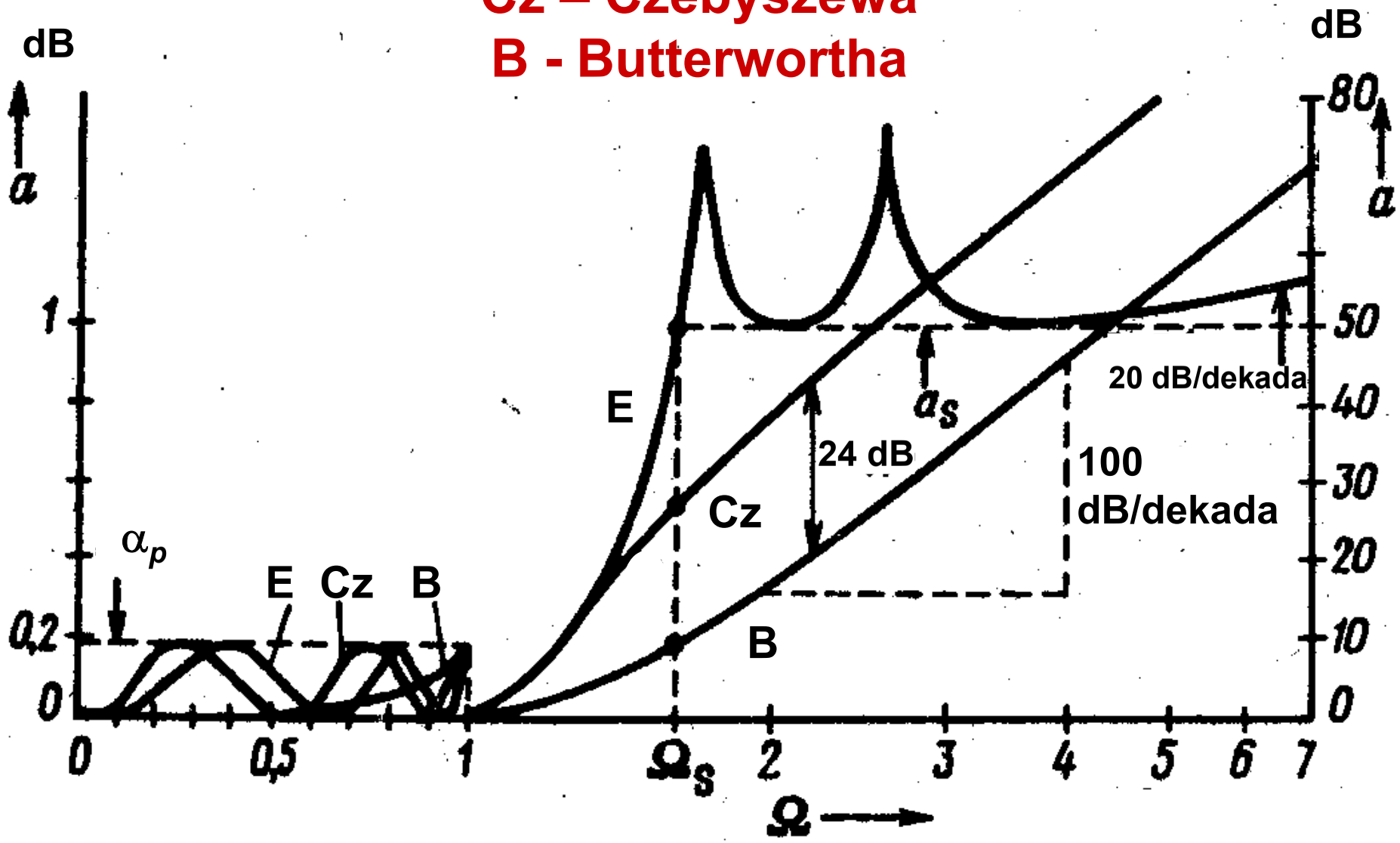
Porównanie typów filtrów

$n = 5$

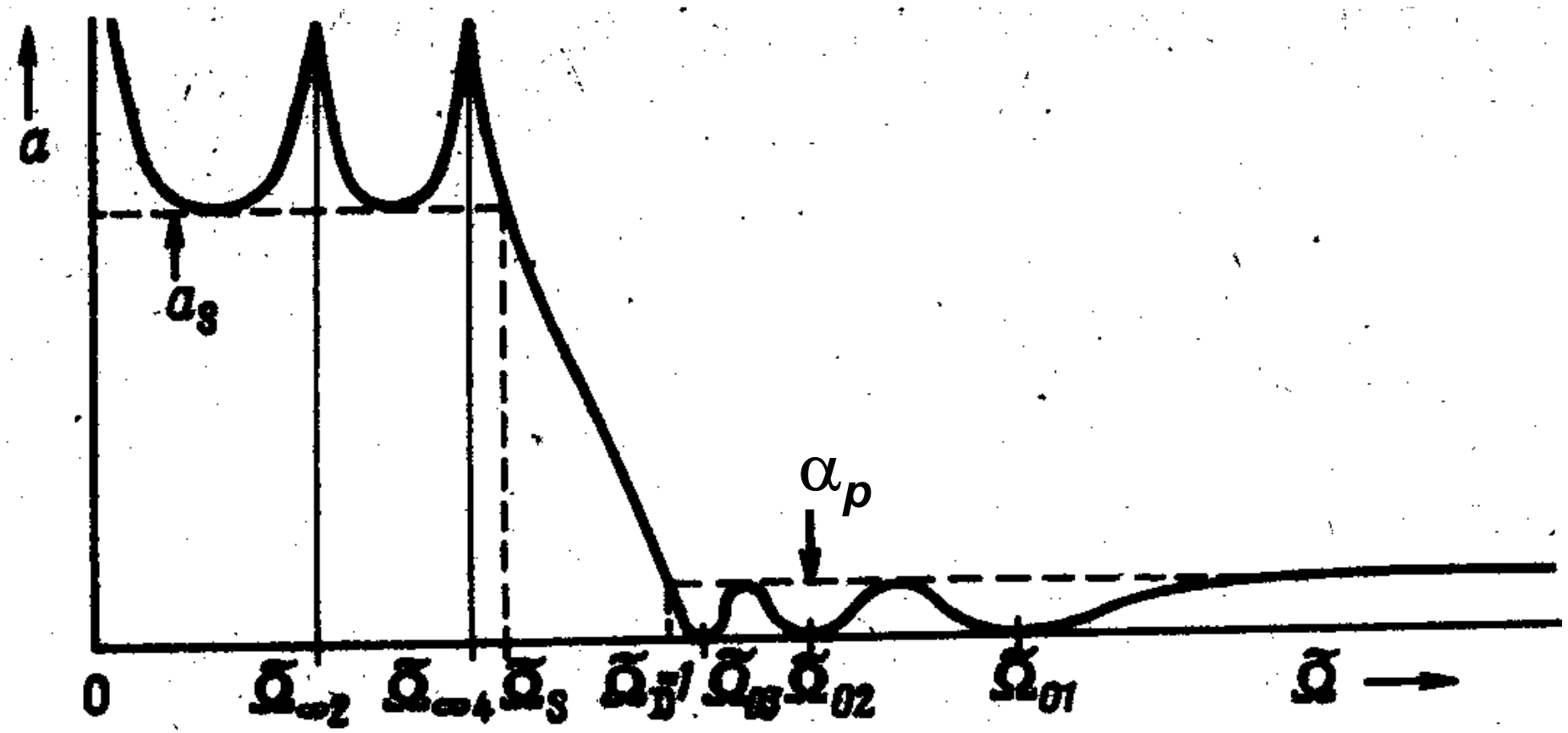
E – eliptyczny (Cauera)

Cz – Czebyszewa

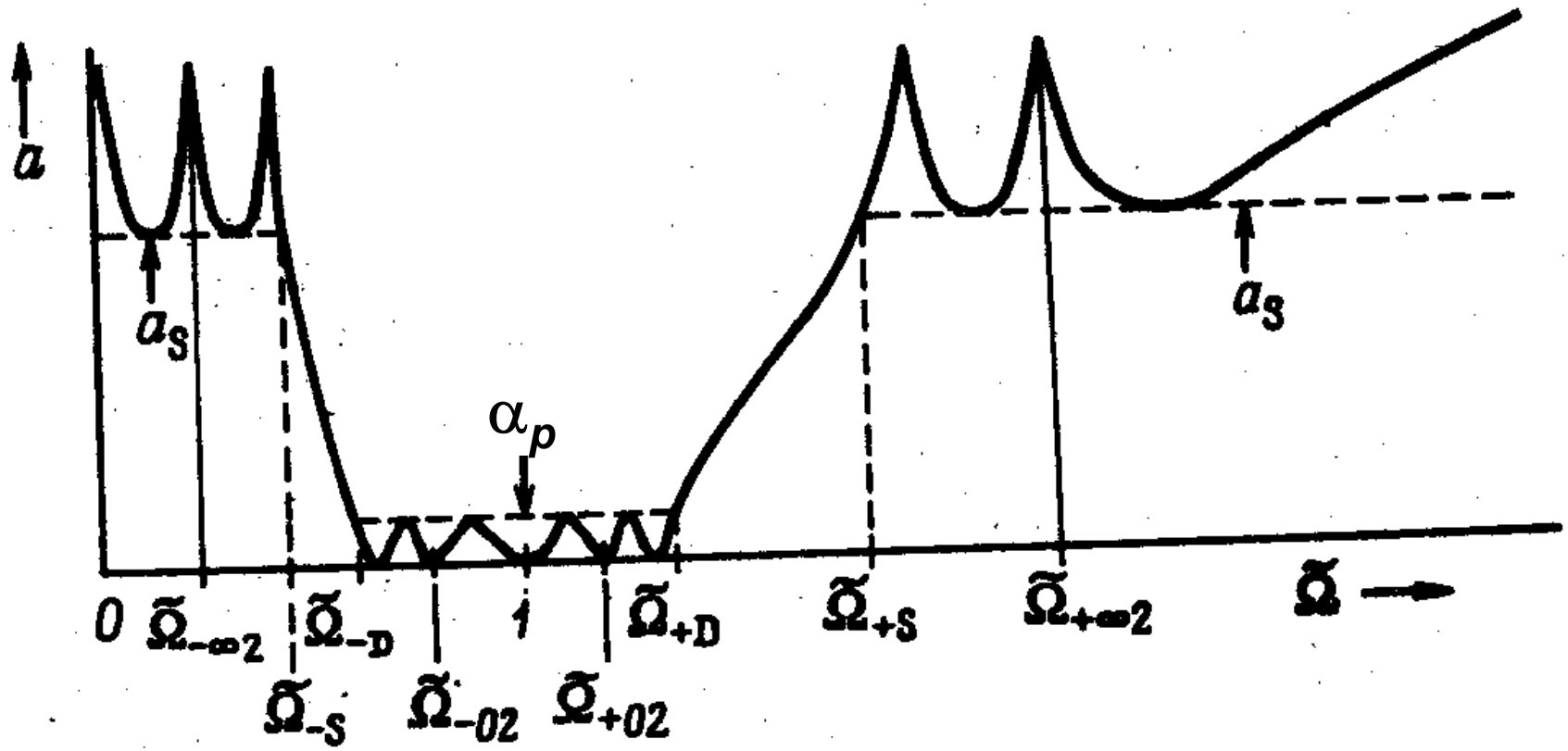
B - Butterwortha



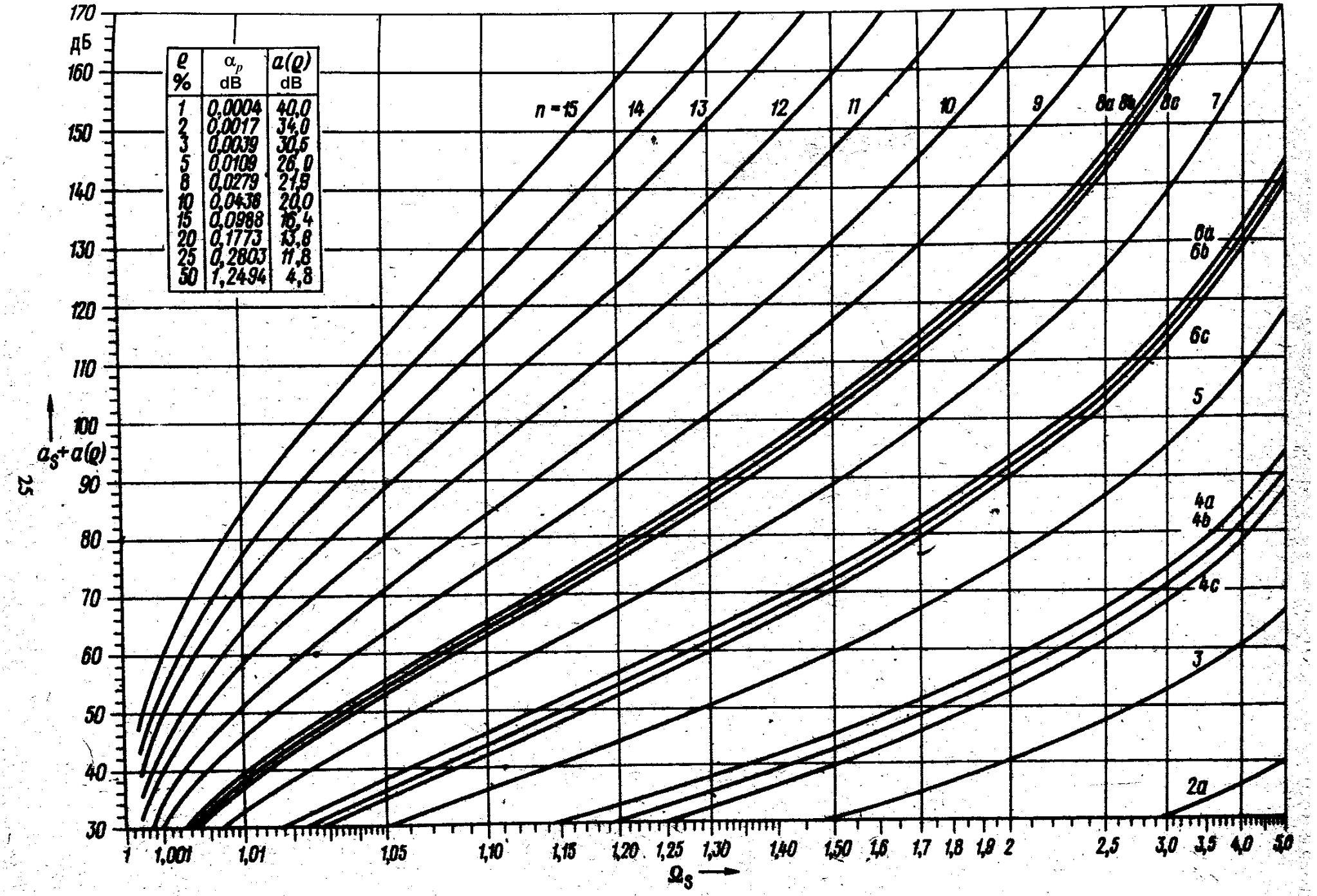
Filtr górnoprzepustowy



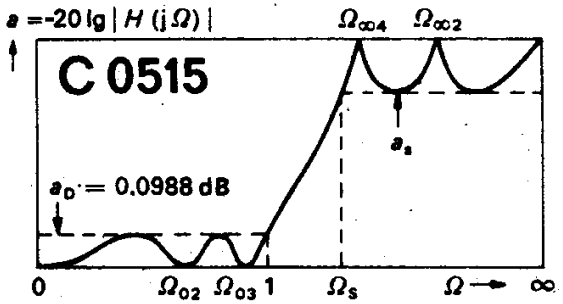
Filtr pasmowoprzepustowy

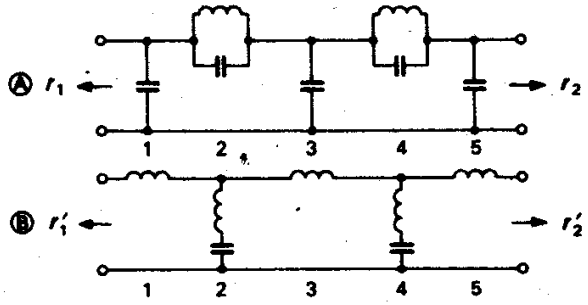


Nomogram dla filtrów eliptycznych



Tablice filtrów





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

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

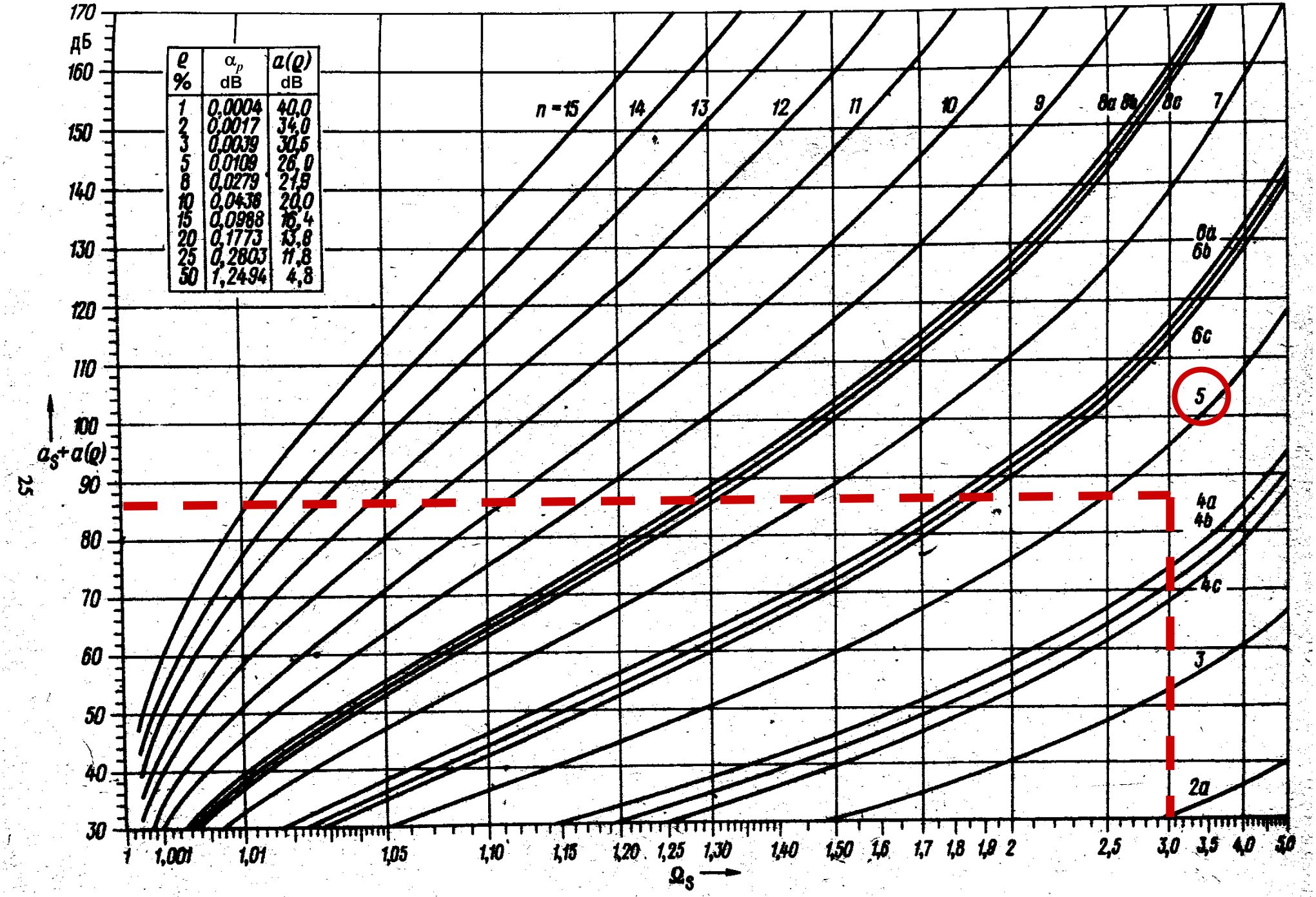
Θ	Ω_s	a_s dB	Ⓐ ν	$r_1=1$ $c_{2\nu-1}$	$l_{2\nu}$	$r_2=1$ $c_{2\nu}$	$r_1=\infty$ $c_{2\nu-1}$	$l_{2\nu}$	$r_2=1$ $c_{2\nu}$	$\Omega_{\infty 2\nu}$	$\Omega_{0\nu}$	$-\alpha_\nu$	$\pm\beta_\nu$	C
P			1	0.423857	1.109671		1.059641	1.162063			0.0000000000	1.4581205301	0.0000000000	0.151716521
			2	1.371629	1.109671		0.947772	0.613411			0.0000000000	1.1798442887	0.8570617436	
			3	0.423857			0.211928				0.0000000000	0.4505840236	1.3867550317	
T			1	1.143980	1.371502		1.374943	1.591557			0.0000000000	0.5402488996	0.0000000000	2.427464340
			2	1.972209	1.371502		1.554653	1.247452			0.5877852523	0.4370705409	0.8680791260	
			3	1.143980			0.571990				0.9510565163	0.1669460912	1.0809747330	
16	3.627955279	86.9	1	1.127504	1.349692	0.019953	1.367902	1.574318	0.017106	6.093615131	0.0000000000	0.5541848138	0.0000000000	1244.254423782
			2	1.919875	1.305891	0.052820	1.515051	1.161245	0.059399	3.807568154	0.5953699406	0.4356211551	0.8829299209	
			3	1.095838			0.516447				0.9526274037	0.1589305952	1.0791371351	
17	3.420303820	84.2	1	1.125360	1.346860	0.022572	1.366986	1.572082	0.019338	5.735288898	0.0000000000	0.5560306714	0.0000000000	972.985289797
			2	1.913178	1.297473	0.059842	1.510078	1.150169	0.067507	3.588776130	0.5963601341	0.4354056787	0.8848898288	
			3	1.089629			0.509186				0.9530557205	0.1579045234	1.0788932579	
18	3.236067978	81.7	1	1.123082	1.343851	0.025361	1.366012	1.569706	0.021712	5.416797510	0.0000000000	0.5580011698	0.0000000000	771.312352195
			2	1.906087	1.288555	0.067347	1.504838	1.138432	0.076228	3.394603138	0.5974135034	0.4351704283	0.8869338923	
			3	1.083043			0.501458				0.9532978808	0.1568180892	1.0786328722	
19	3.071553487	79.3	1	1.120667	1.340664	0.028323	1.364980	1.567190	0.024229	5.131823431	0.0000000000	0.5600987277	0.0000000000	618.912076458
			2	1.898604	1.279139	0.075345	1.499339	1.126035	0.085590	3.221164045	0.5985306252	0.4349131215	0.8891226403	
			3	1.076079			0.493258				0.9535538841	0.1556716269	1.0783556795	
20	2.923804400	77.0	1	1.118115	1.337298	0.031460	1.363889	1.564531	0.026891	4.875346566	0.0000000000	0.5623259501	0.0000000000	502.053825632
			2	1.890733	1.269226	0.083950	1.493587	1.112981	0.095621	3.065350869	0.5997121149	0.4346325585	0.8914378857	
			3	1.068737			0.484579				0.9538237302	0.1544654926	1.0780613663	
21	2.790428110	74.9	1	1.115425	1.333751	0.034775	1.362738	1.561729	0.029699	4.643294870	0.0000000000	0.5646856438	0.0000000000	411.266101867
			2	1.882476	1.258819	0.092873	1.487591	1.099273	0.106352	2.924647748	0.6009886270	0.4343271307	0.6938806280	
			3	1.061017			0.475415				0.9541074174	0.1532000667	1.0777496050	
22	2.669467163	72.8	1	1.112596	1.330023	0.038271	1.361528	1.558781	0.032855	4.432336604	0.0000000000	0.5671808212	0.0000000000	339.692163187
			2	1.873835	1.247920	0.102431	1.481360	1.084912	0.117821	2.796996367	0.6022708564	0.4338951083	0.6964522415	
			3	1.052918			0.465759				0.9544049445	0.1518757525	1.0774200528	
23	2.559304665	70.8	1	1.109627	1.326111	0.041951	1.360257	1.555686	0.035761	4.239719400	0.0000000000	0.5698147173	0.0000000000	283.173898578
			2	1.864813	1.236531	0.112538	1.474902	1.069902	0.130065	2.680696497	0.6038495399	0.4336346378	0.6991540957	
			3	1.044440			0.455602				0.9547183090	0.1504929788	1.0770723534	
24	2.458593336	68.9	1	1.106515	1.322015	0.045818	1.358924	1.552442	0.039017	4.063149555	0.0000000000	0.5725908012	0.0000000000	237.657807838
			2	1.855414	1.224665	0.123213	1.468229	1.054247	0.143129	2.574331394	0.6050954567	0.4332437343	0.7019876342	
			3	1.035582			0.444936				0.9550415076	0.1490521989	1.0767061373	

Θ	Ω_s	a_s dB	ν Ⓑ	$l_{2\nu-1}$ $r_1'=1$	$c_{2\nu}$	$l_{2\nu}$ $r_2'=1$	$l_{2\nu-1}$ $r_1'=0$	$c_{2\nu}$	$l_{2\nu}$ $r_2'=1$	$\Omega_{\infty 2\nu}$	$\Omega_{0\nu}$	$-\alpha_\nu$	$\pm\beta_\nu$	C

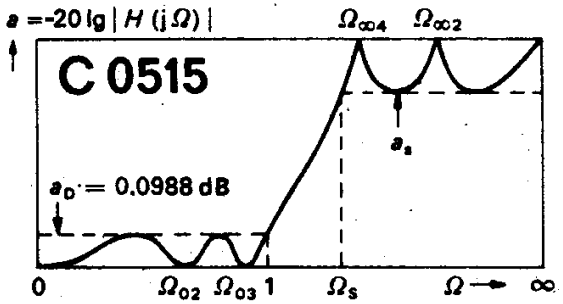
Przykład

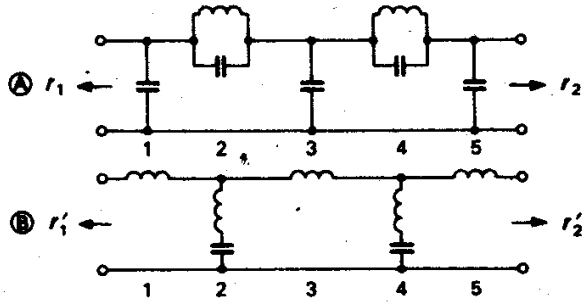
$\alpha_p = 0{,}0988$ dB, $\alpha_s = 70$ dB, $\Omega_s = 3$

Nomogram dla filtrów eliptycznych



Tablice filtrów





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

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

Θ	Ω_s	a_s dB	Ⓐ ν	$r_1=1$ $c_{2\nu-1}$	$l_{2\nu}$	$r_2=1$ $c_{2\nu}$	$r_1=\infty$ $c_{2\nu-1}$	$l_{2\nu}$	$r_2=1$ $c_{2\nu}$	$\Omega_{\infty 2\nu}$	$\Omega_{0\nu}$	$-\alpha_\nu$	$\pm\beta_\nu$	C
P			1	0.423857	1.109671		1.059641	1.162063			0.0000000000	1.4581205301	0.0000000000	0.151716521
			2	1.371629	1.109671		0.947772	0.613411			0.0000000000	1.1798442887	0.8570617436	
			3	0.423857			0.211928				0.0000000000	0.4505840236	1.3867550317	
T			1	1.143980	1.371502		1.374943	1.591557			0.0000000000	0.5402488996	0.0000000000	2.427464340
			2	1.972209	1.371502		1.554653	1.247452			0.5877852523	0.4370705409	0.8680791260	
			3	1.143980			0.571990				0.9510565163	0.1669460912	1.0809747330	
16	3.627955279	86.9	1	1.127504	1.349692	0.019953	1.367902	1.574318	0.017106	6.093615131	0.0000000000	0.5541848138	0.0000000000	1 244.254423782
			2	1.919875	1.305891	0.052820	1.515051	1.161245	0.059399	3.807568154	0.5953699406	0.4356211551	0.8829299209	
			3	1.095838			0.516447				0.9526274037	0.1589305952	1.0791371351	
17	3.420303820	84.2	1	1.125360	1.346860	0.022572	1.366986	1.572082	0.019338	5.735288898	0.0000000000	0.5560306714	0.0000000000	972.985289797
			2	1.913178	1.297473	0.059842	1.510078	1.150169	0.067507	3.588776130	0.5963601341	0.4354059787	0.8848898288	
			3	1.089629			0.509186				0.9530557205	0.1579045234	1.0788932579	
18	3.236067978	81.7	1	1.123082	1.343851	0.025361	1.366012	1.569706	0.021712	5.416797510	0.0000000000	0.5580011698	0.0000000000	771.312352195
			2	1.906087	1.288555	0.067347	1.504838	1.138432	0.076228	3.394603138	0.5974135034	0.4351704283	0.8869338923	
			3	1.083043			0.501458				0.9532978808	0.1568180892	1.0786328722	
19	3.071553487	79.3	1	1.120667	1.340664	0.028323	1.364980	1.567190	0.024229	5.131823431	0.0000000000	0.5600987277	0.0000000000	618.912076458
			2	1.898604	1.279139	0.075345	1.499339	1.126035	0.085590	3.221164045	0.5985306252	0.4349131215	0.8891226403	
			3	1.076079			0.493258				0.9535538841	0.1556716269	1.0783558795	
20	2.923804400	77.0	1	1.118115	1.337298	0.031460	1.363889	1.564531	0.026891	4.876346566	0.0000000000	0.5623259501	0.0000000000	502.053825632
			2	1.890733	1.269226	0.083850	1.493587	1.112981	0.095621	3.065350869	0.5997121149	0.4346325585	0.8914378857	
			3	1.068737			0.484579				0.9538237302	0.1544654926	1.0780613663	
21	2.790428110	74.9	1	1.115425	1.333751	0.034775	1.362738	1.561729	0.029699	4.643294870	0.0000000000	0.5646856438	0.0000000000	411.266101867
			2	1.882476	1.258819	0.092873	1.487591	1.099273	0.106352	2.924647748	0.6009886270	0.4343271307	0.6938806280	
			3	1.061017			0.475415				0.9541074174	0.1532000667	1.0777496050	
22	2.669467163	72.8	1	1.112596	1.330023	0.038271	1.361528	1.558781	0.032855	4.432336604	0.0000000000	0.5671808212	0.0000000000	339.692163187
			2	1.873835	1.247920	0.102431	1.481360	1.084912	0.117821	2.796996367	0.6022708564	0.4339951083	0.6964522415	
			3	1.052918			0.465759				0.9544049445	0.1518757525	1.0774200528	
23	2.559304665	70.8	1	1.109627	1.326111	0.041951	1.360257	1.555686	0.035761	4.239719400	0.0000000000	0.5698147173	0.0000000000	283.173898578
			2	1.864813	1.236531	0.112538	1.474902	1.069902	0.130065	2.680696497	0.6038495399	0.4336346378	0.6991540957	
			3	1.044440			0.455602				0.9547183090	0.1504929788	1.0770723534	
24	2.458593336	68.9	1	1.106515	1.322015	0.045818	1.358924	1.552442	0.039017	4.063149555	0.0000000000	0.5725908012	0.0000000000	237.657807838
			2	1.855414	1.224665	0.123213	1.468229	1.054247	0.143129	2.574331394	0.6050954567	0.4332437343	0.7019876342	
			3	1.035582			0.444936				0.9550415076	0.1490521989	1.0767061373	

Θ	Ω_s	a_s dB	ν Ⓑ	$l_{2\nu-1}$ $r_1'=1$	$c_{2\nu}$	$l_{2\nu}$ $r_2'=1$	$l_{2\nu-1}$ $r_1'=0$	$c_{2\nu}$	$l_{2\nu}$ $r_2'=1$	$\Omega_{\infty 2\nu}$	$\Omega_{0\nu}$	$-\alpha_\nu$	$\pm\beta_\nu$	C

C 0515