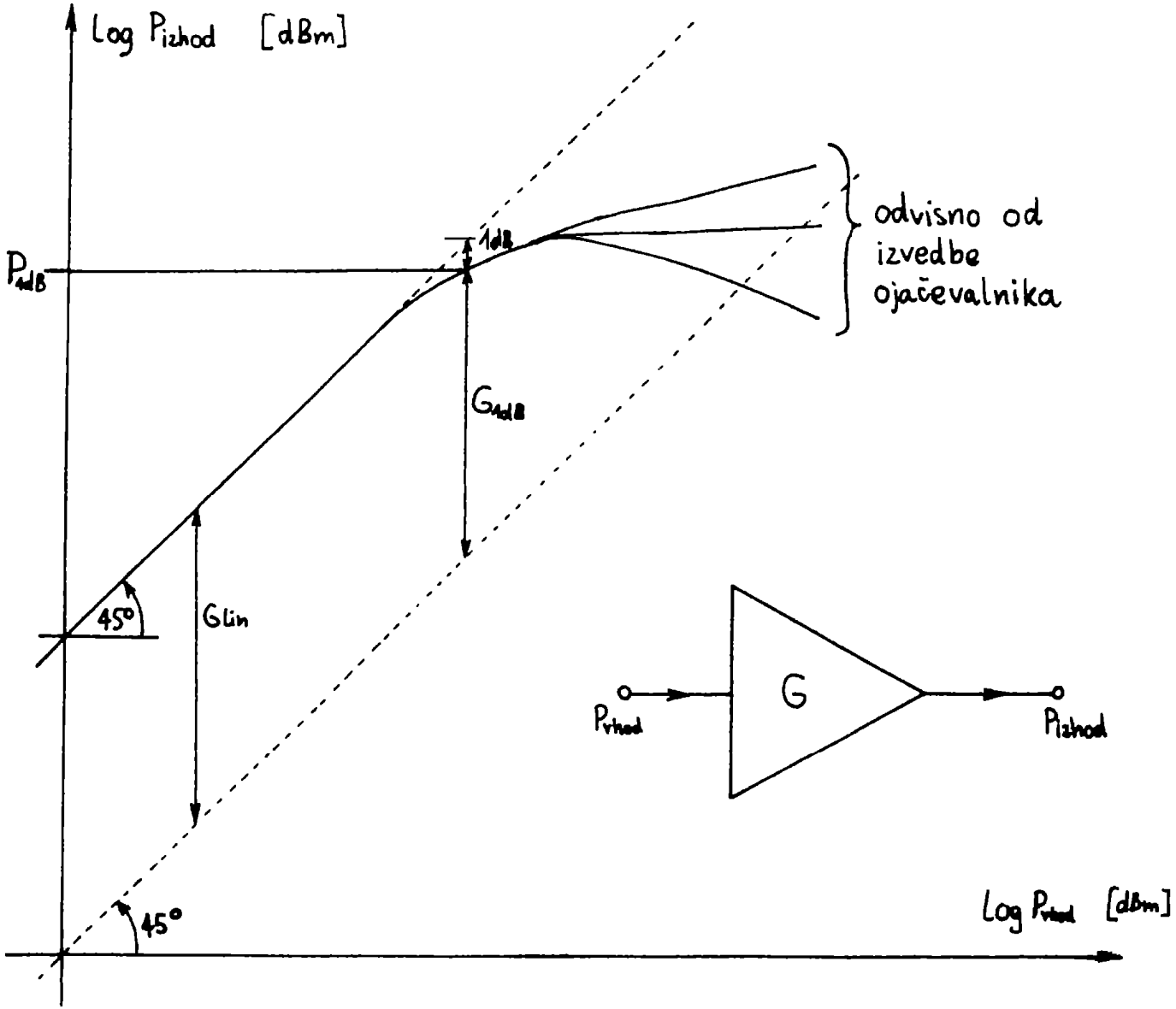
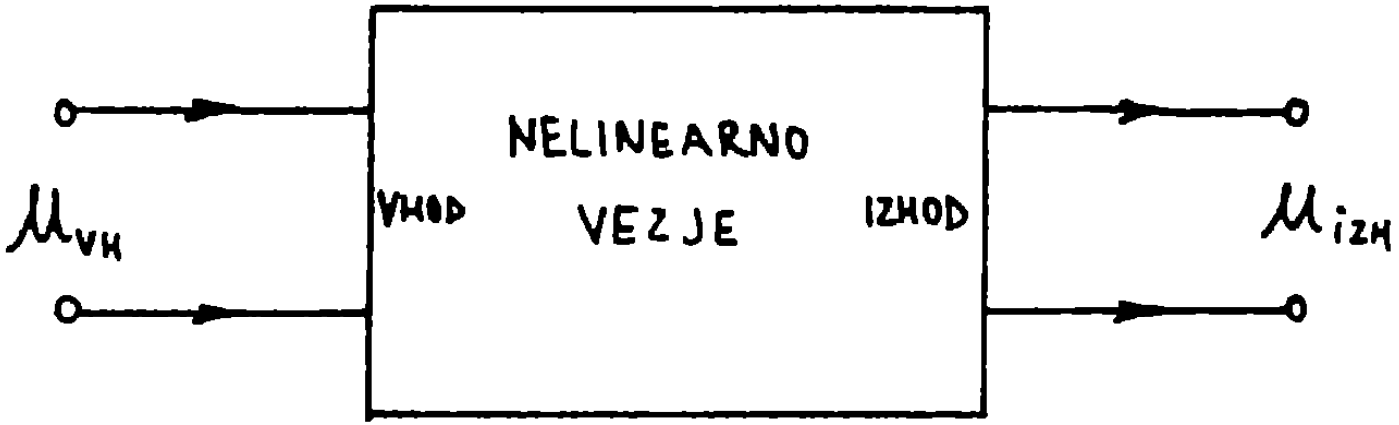
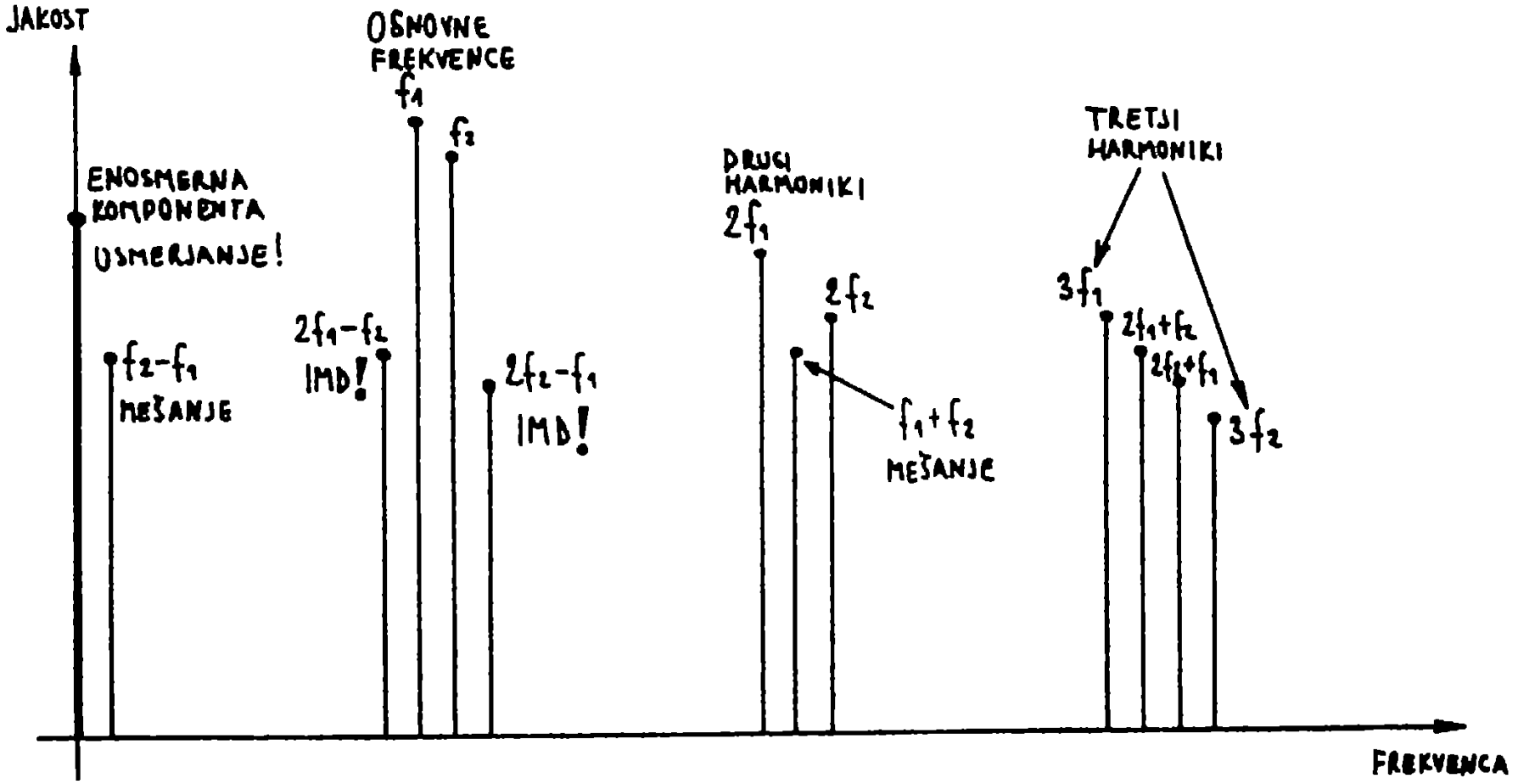
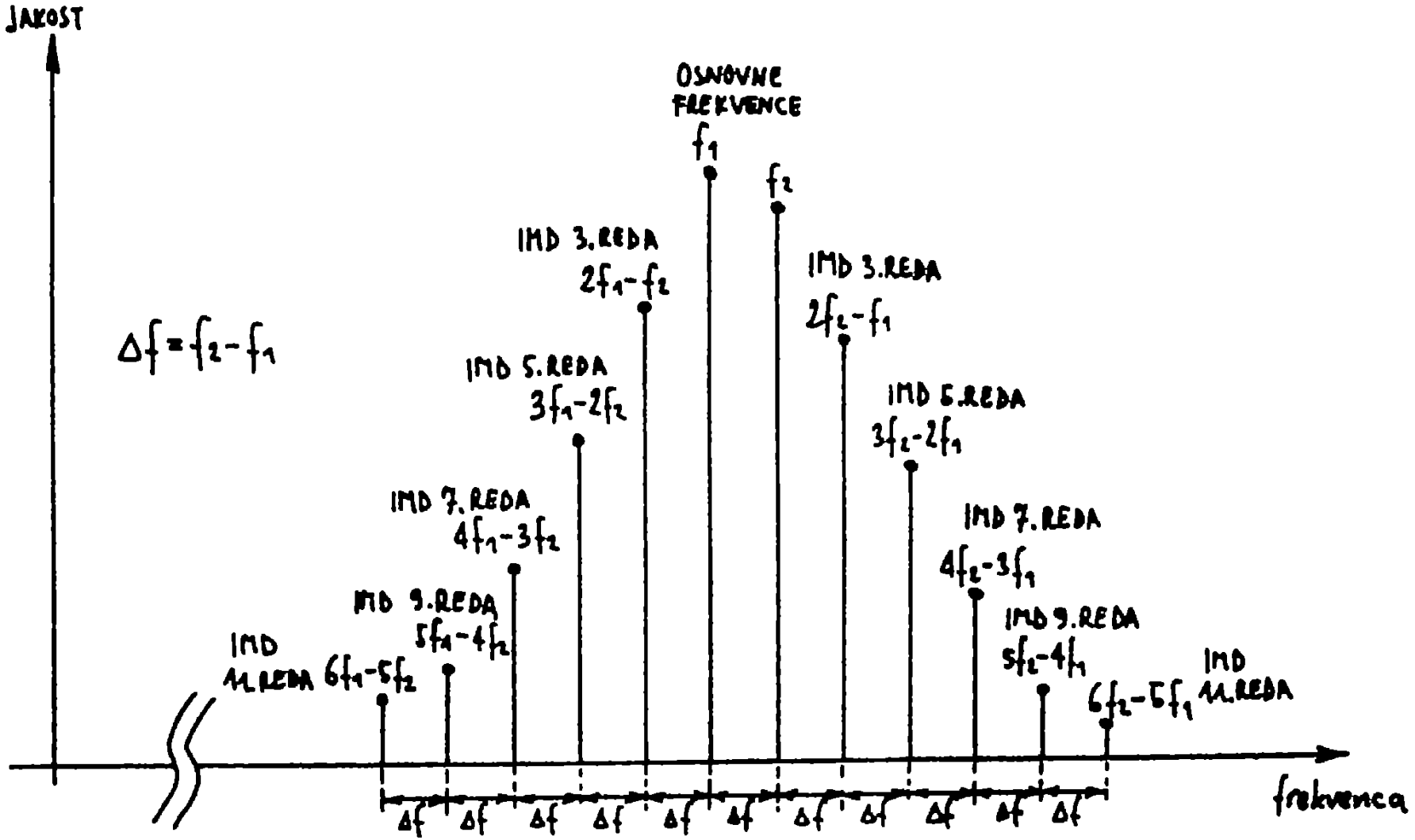

Log P izhod [dBm]
P 1dB
1dB
G 1dB
odvisno od
izvedbe
ojačevalnika
45°
G lin
45°
G
P vhod
P izhod
Log P vhod [dBm]

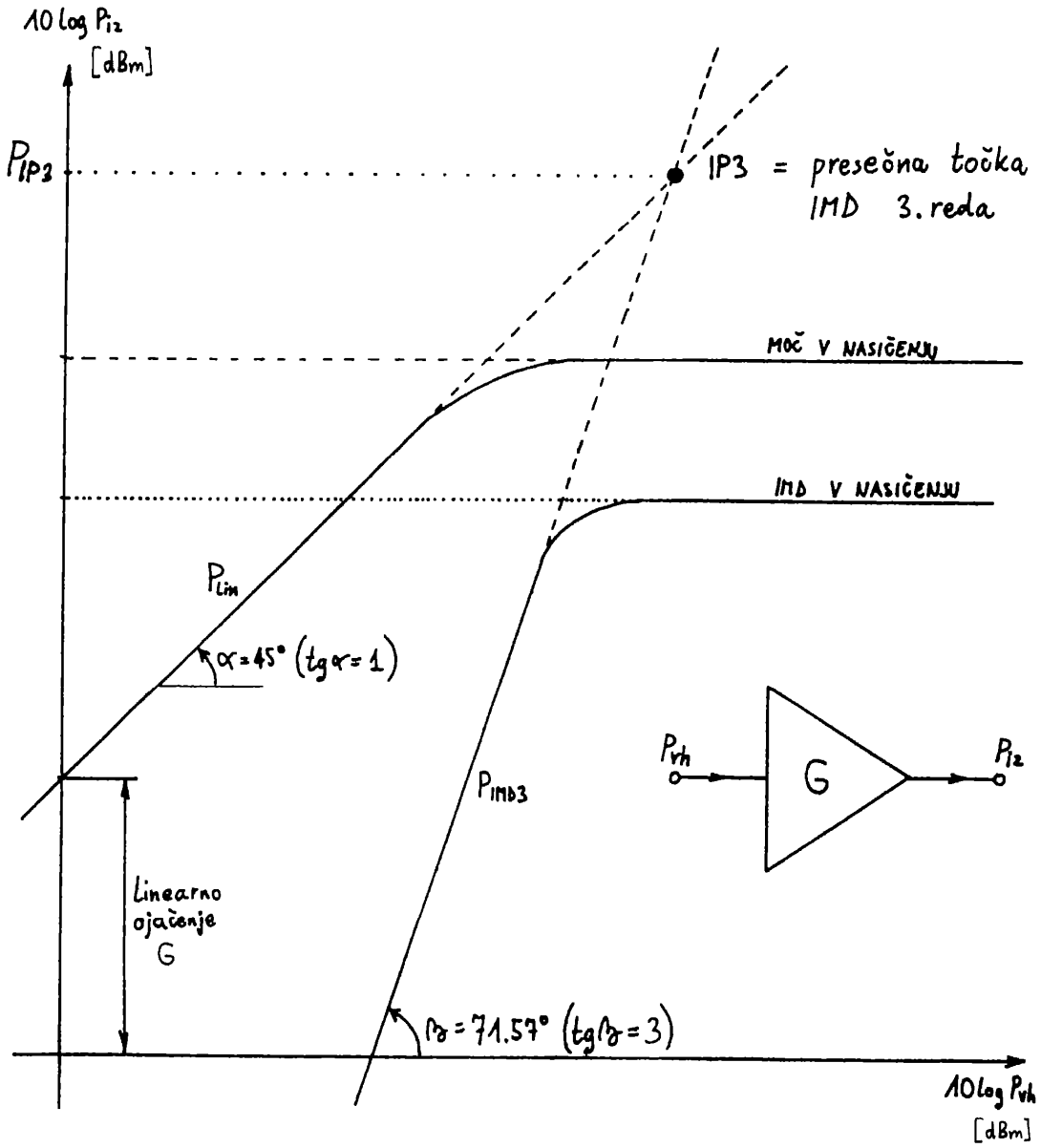


$$u_{IZH} = C_0 + C_1 \cdot u_{VH} + C_2 \cdot u_{VH}^2 + C_3 \cdot u_{VH}^3 + C_4 \cdot u_{VH}^4 + \ldots$$

ČLEN	PRISPEVKI PRI KRMILJENJU Z ENO FREKVENCO f	PRISPEVKI PRI KRMILJENJU Z DVEMA FREKVENCAMA f_1 in f_2
LINEARNI ČLEN $C_1 \cdot \mu_{VH}$	f	f_1 ; f_2
KVADRATNI ČLEN $C_2 \cdot \mu_{VH}^2$	0 (= enosmerna!) $2f$	0 ; $2f_1$; $2f_2$; f_1+f_2 ; f_1-f_2
KUBNI ČLEN $C_3 \cdot \mu_{VH}^3$	f $3f$	f_1 ; f_2 ; $3f_1$; $3f_2$; $2f_1+f_2$; $\boxed{2f_1-f_2}$; f_1+2f_2 ; $\boxed{f_1-2f_2}$
$C_4 \cdot \mu_{VH}^4$	0 (= enosmerna) $2f$ $4f$	0 ; $2f_1$; $2f_2$; $4f_1$; $4f_2$; $3f_1+f_2$; $3f_1-f_2$; $2f_1+2f_2$; $2f_1-2f_2$; f_1+3f_2 ; f_1-3f_2 ; f_1+f_2 ; f_1-f_2
$C_5 \cdot \mu_{VH}^5$	f $3f$ $5f$	f_1 ; f_2 ; $3f_1$; $3f_2$; $5f_1$; $5f_2$; .....; $\boxed{3f_1-2f_2}$; $\boxed{2f_1-3f_2}$; ----
⋮	⋮	⋮


JAKOST
OSNOVNE FREKVENCE
f_1
f_2
ENOSMERNA KOMPONENTA
USMERJANJE!
f_2-f_1
MEŠANJE
$2f_1-f_2$
IMD!
$2f_2-f_1$
IMD!
DRUGI HARMONIKI
$2f_1$
$2f_2$
f_1+f_2
MEŠANJE
TRETJI HARMONIKI
$3f_1$
$2f_1+f_2$
$2f_2+f_1$
$3f_2$
FREKVENCA


JAKOST
OSNOVNE FREKVENCE
f_1
f_2
IMD 3.REDA
$2f_1-f_2$
IMD 3.REDA
$2f_2-f_1$
$\Delta f = f_2 - f_1$
IMD 5.REDA
$3f_1-2f_2$
IMD 5.REDA
$3f_2-2f_1$
IMD 7.REDA
$4f_1-3f_2$
IMD 7.REDA
$4f_2-3f_1$
IMD 9.REDA
$5f_1-4f_2$
IMD 9.REDA
$5f_2-4f_1$
IMD 11.REDA
$6f_1-5f_2$
IMD 11.REDA
$6f_2-5f_1$
Δf
frekvenca

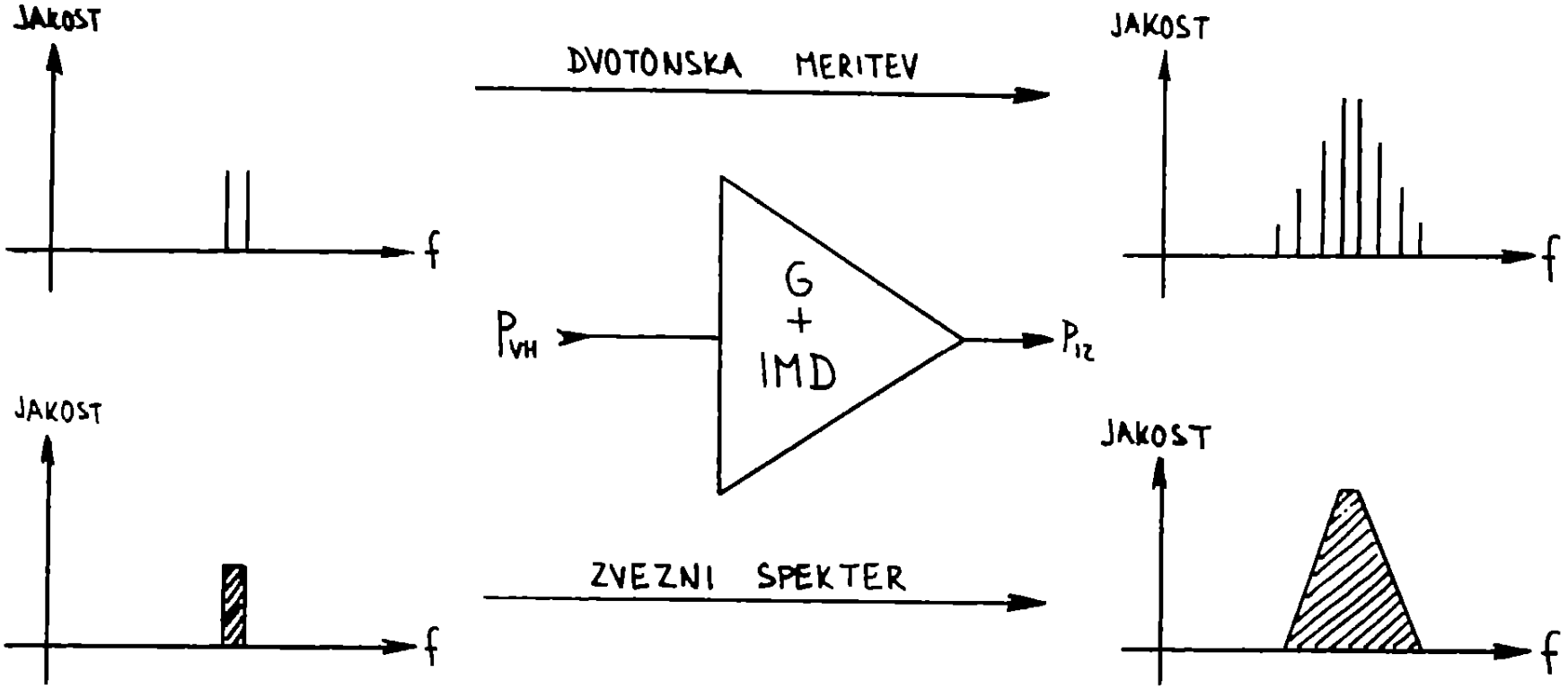

10 log Piz
[dBm]
PIP3
IP3 = presečna točka
IMD 3. reda
MOČ V NASIČENJU
IMD V NASIČENJU
Plin
α = 45° (tg α = 1)
Prh
G
Piz
PIMD3
Linearno
ojačenje
G
β = 71.57° (tg β = 3)
10 log Prh
[dBm]

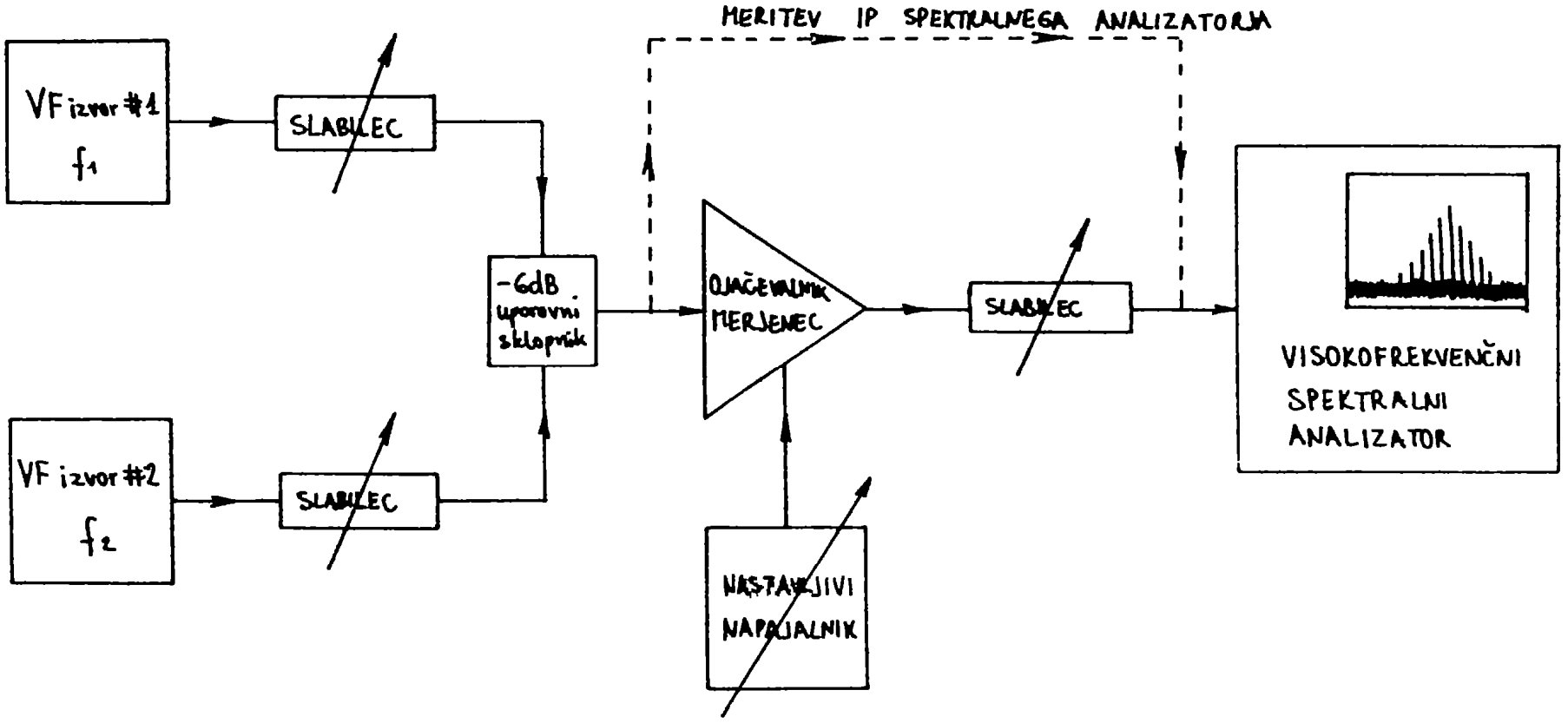
$$P_{IMD3} = \frac{P_{lin}^3}{P_{IP3}^2} \quad ; \quad P_{IMDn} = \frac{P_{lin}^n}{P_{IPn}^{n-1}} \quad \ldots\ldots \text{v linearnih enotah [W]}$$

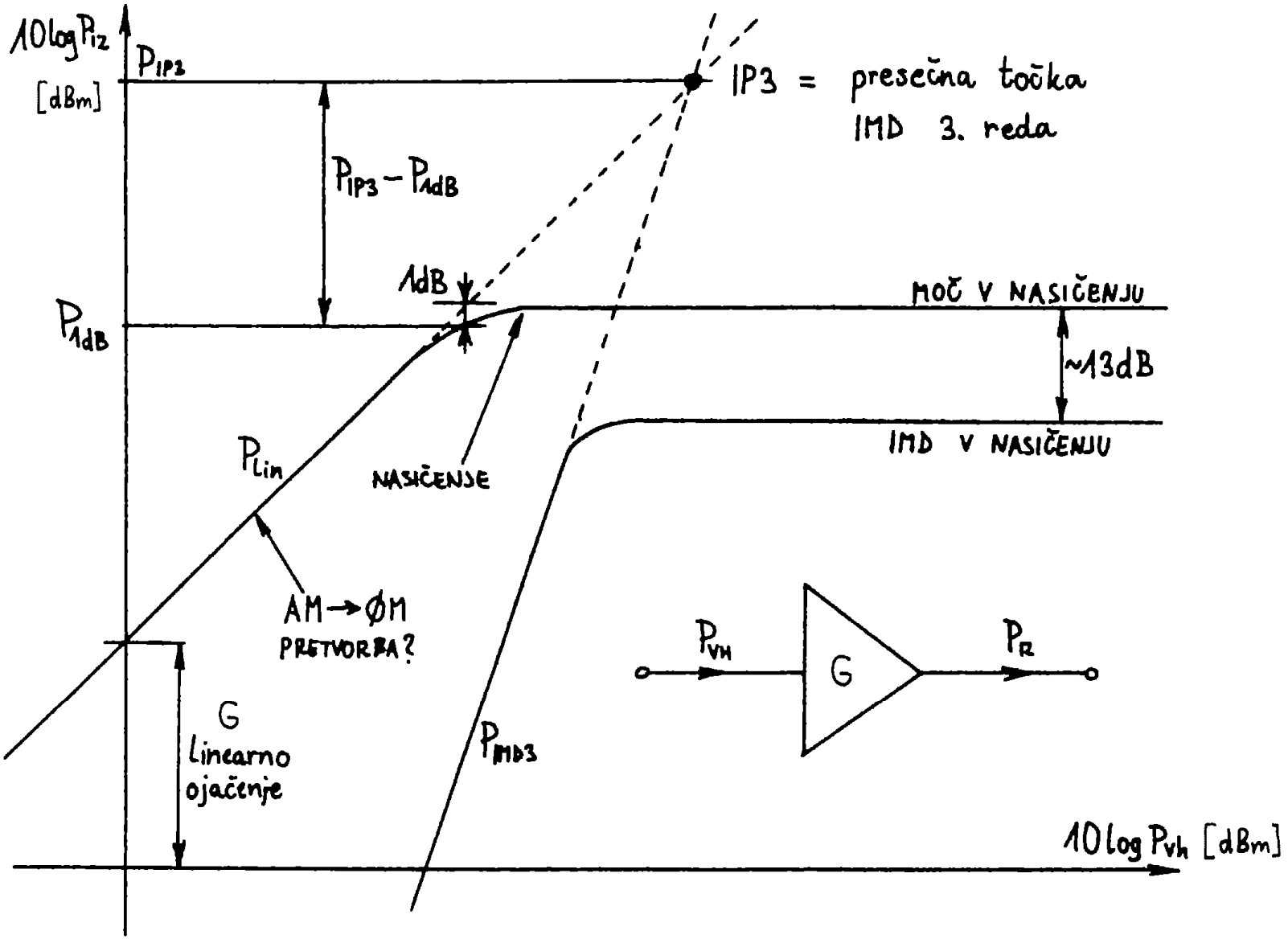
$$P_{IMD3} = 3 \cdot P_{lin} - 2 \cdot P_{IP3} \quad ; \quad P_{IMDn} = n \cdot P_{lin} - (n-1) \cdot P_{IPn} \quad \ldots\ldots \text{v dBW, dBm}$$

$$P_1(f_1), \; P_2(f_2) \longrightarrow P(2f_1 - f_2) = \frac{P_1^2 \cdot P_2}{P_{IP3}^2}$$

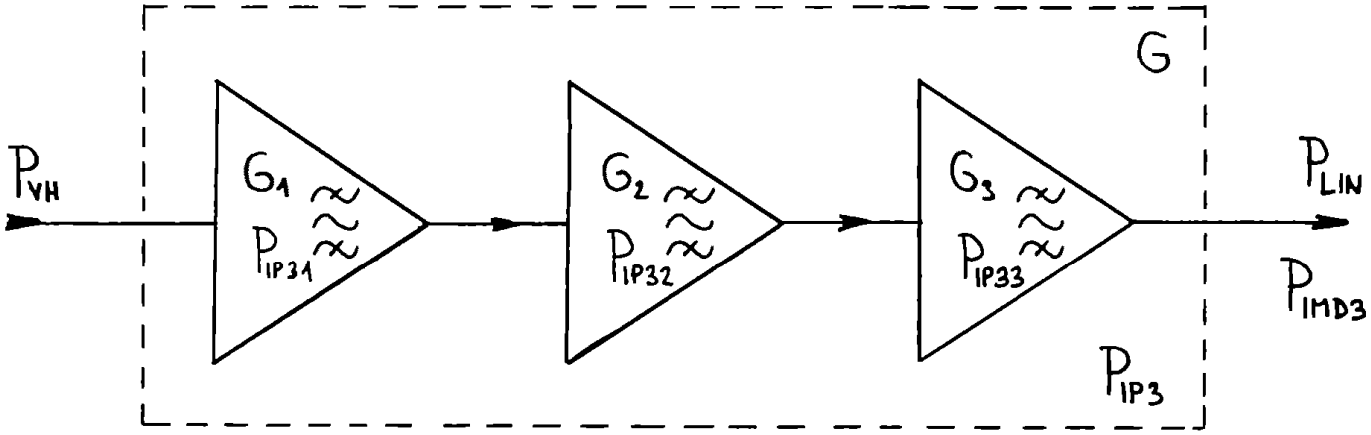
$$P_1(f_1), \; P_2(f_2), \; P_3(f_3) \longrightarrow P(f_1 - f_2 + f_3) = \frac{P_1 \cdot P_2 \cdot P_3}{P_{IP3}^2}$$


JAKOST
f
DVOTONSKA MERITEV
JAKOST
f
G
+
IMD
P_{VH}
P_{IZ}
JAKOST
f
ZVEZNI SPEKTER
JAKOST
f


MERITEV IP SPEKTRALNEGA ANALIZATORJA
VF izvor #1
f1
SLABILEC
-6dB uporovni sklopnik
OJAČEVALNIK MERJENEC
SLABILEC
VISOKOFREKVENČNI SPEKTRALNI ANALIZATOR
VF izvor #2
f2
SLABILEC
NASTAVLJIVI NAPAJALNIK


10 log P_iz
[dBm]
P_IP3
IP3 = presečna točka
IMD 3. reda
P_IP3 − P_1dB
1dB
MOČ V NASIČENJU
P_1dB
~13dB
IMD V NASIČENJU
P_Lin
NASIČENJE
AM→ØM
PRETVORBA?
P_VH
G
P_R
G
Linearno
ojačenje
P_IMD3
10 log P_vh [dBm]

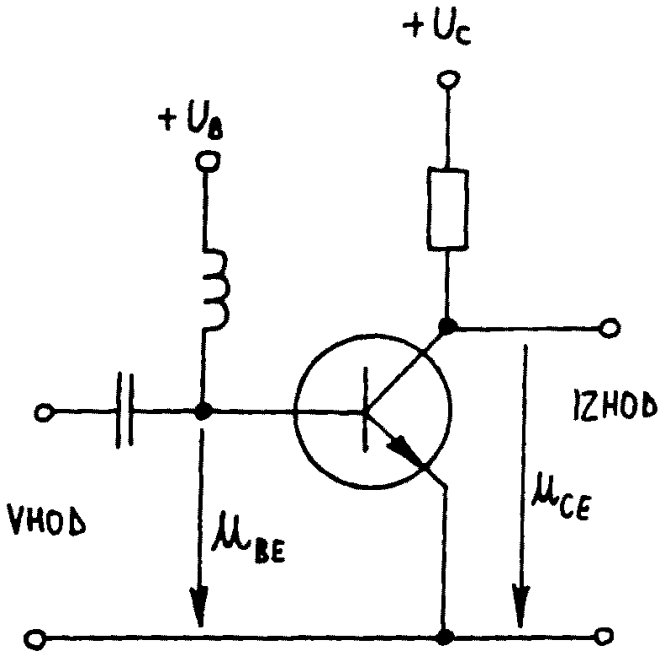
Ojačevalniki s kvadratičnim odzivom	$P_{IP3} - P_{1dB} \approx 20dB$	Trioda Si - JFET Si - MOSFET GaAs FET Ojačevalniki s povratno vezavo
Ojačevalniki z odzivom višjega reda	$P_{IP3} - P_{1dB} \approx 10dB$	Pentoda Klistron TWT Si bipolarni tranzistor Večstopenjski ojačevalniki

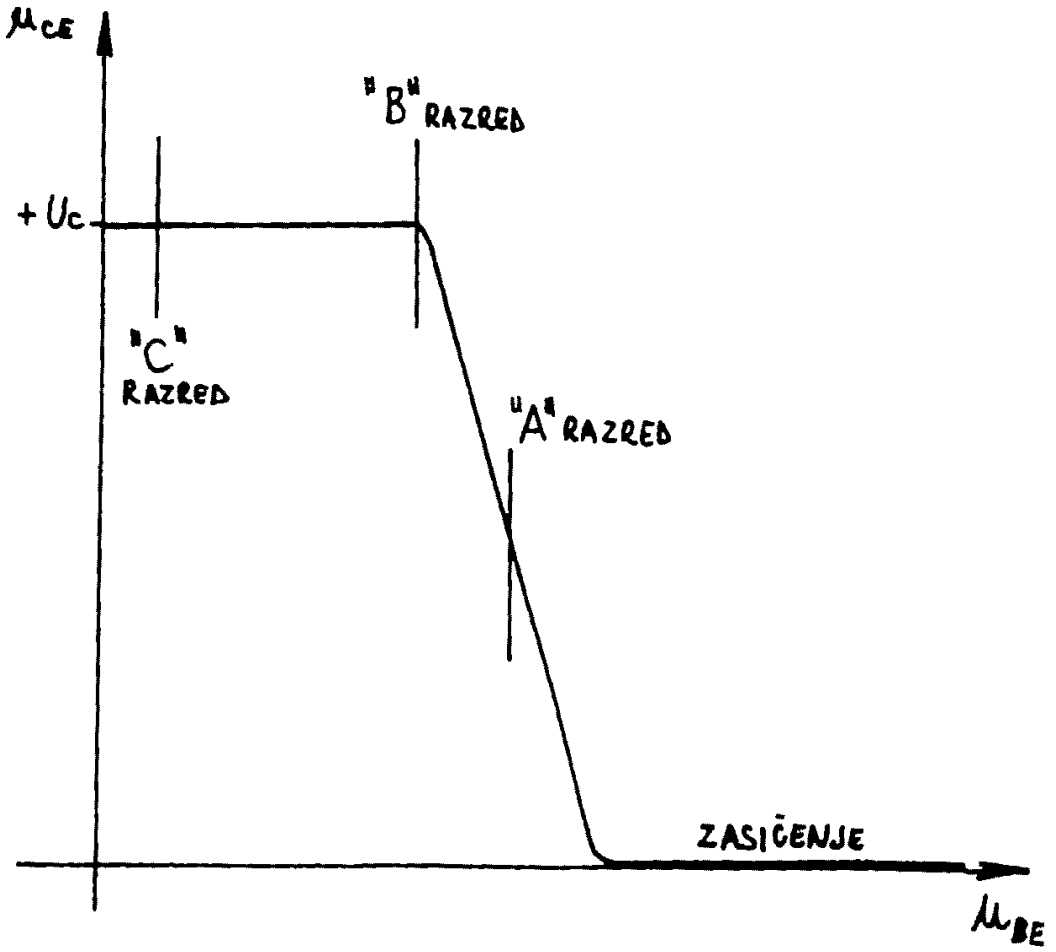


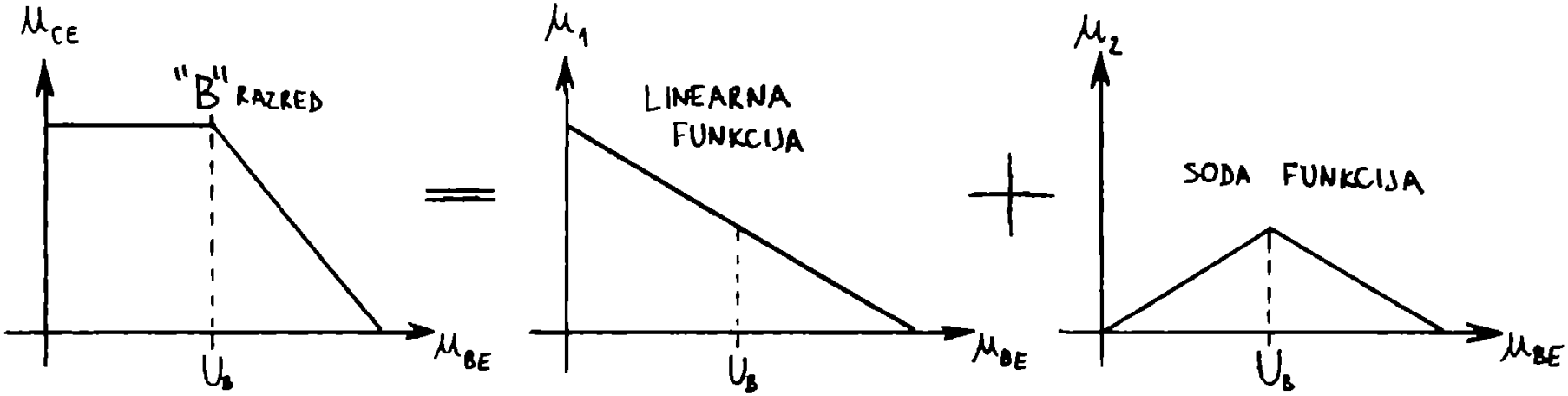
$$G = G_1 \cdot G_2 \cdot G_3$$

$$\sqrt{P_{IMD3}} = \sqrt{P_{IMD33}} + \sqrt{G_3 \cdot P_{IMD32}} + \sqrt{G_2 \cdot G_3 \cdot P_{IMD31}}$$

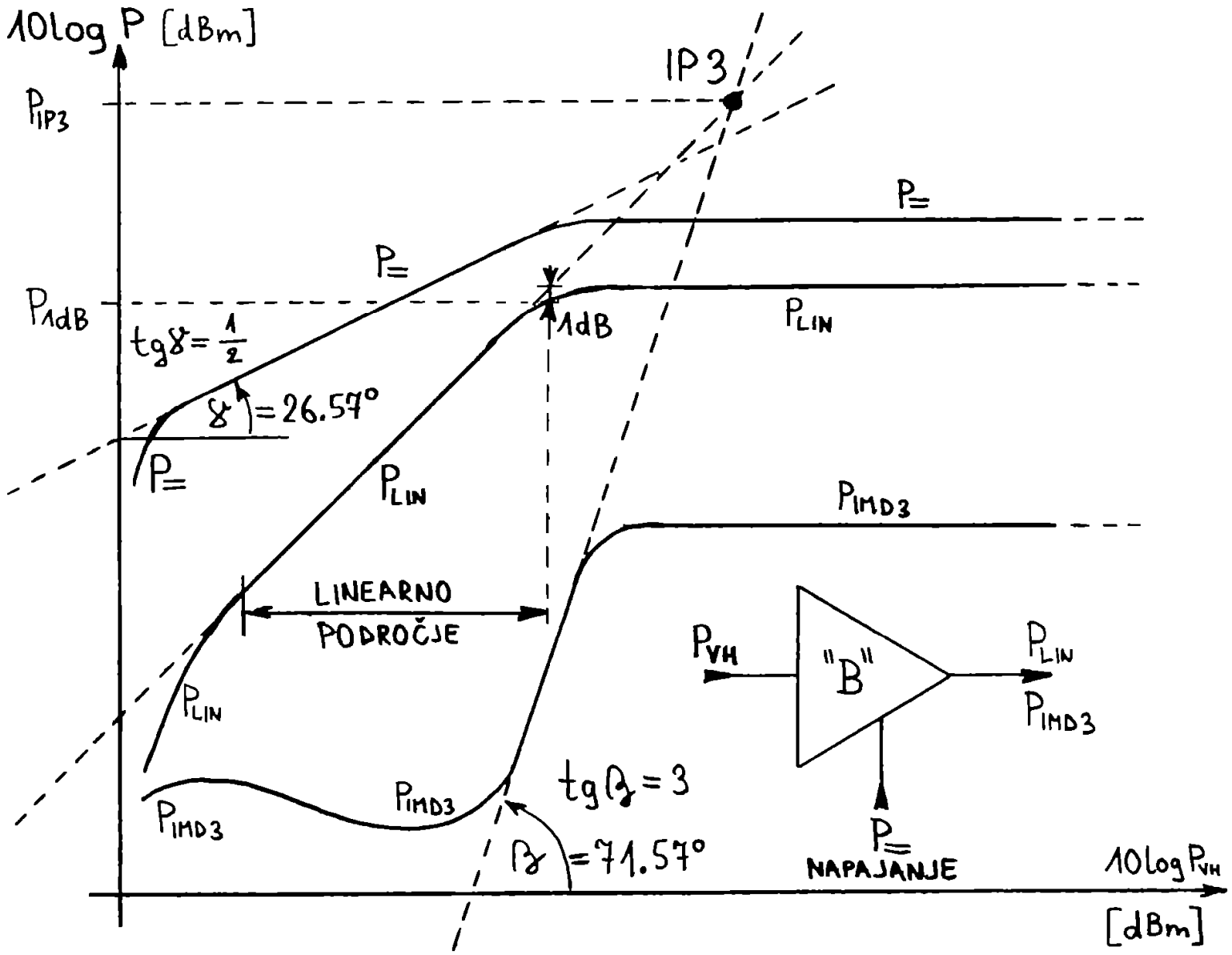
$$P_{IP3} = \frac{1}{\frac{1}{P_{IP33}} + \frac{1}{P_{IP32} \cdot G_3} + \frac{1}{P_{IP31} \cdot G_2 \cdot G_3}}$$

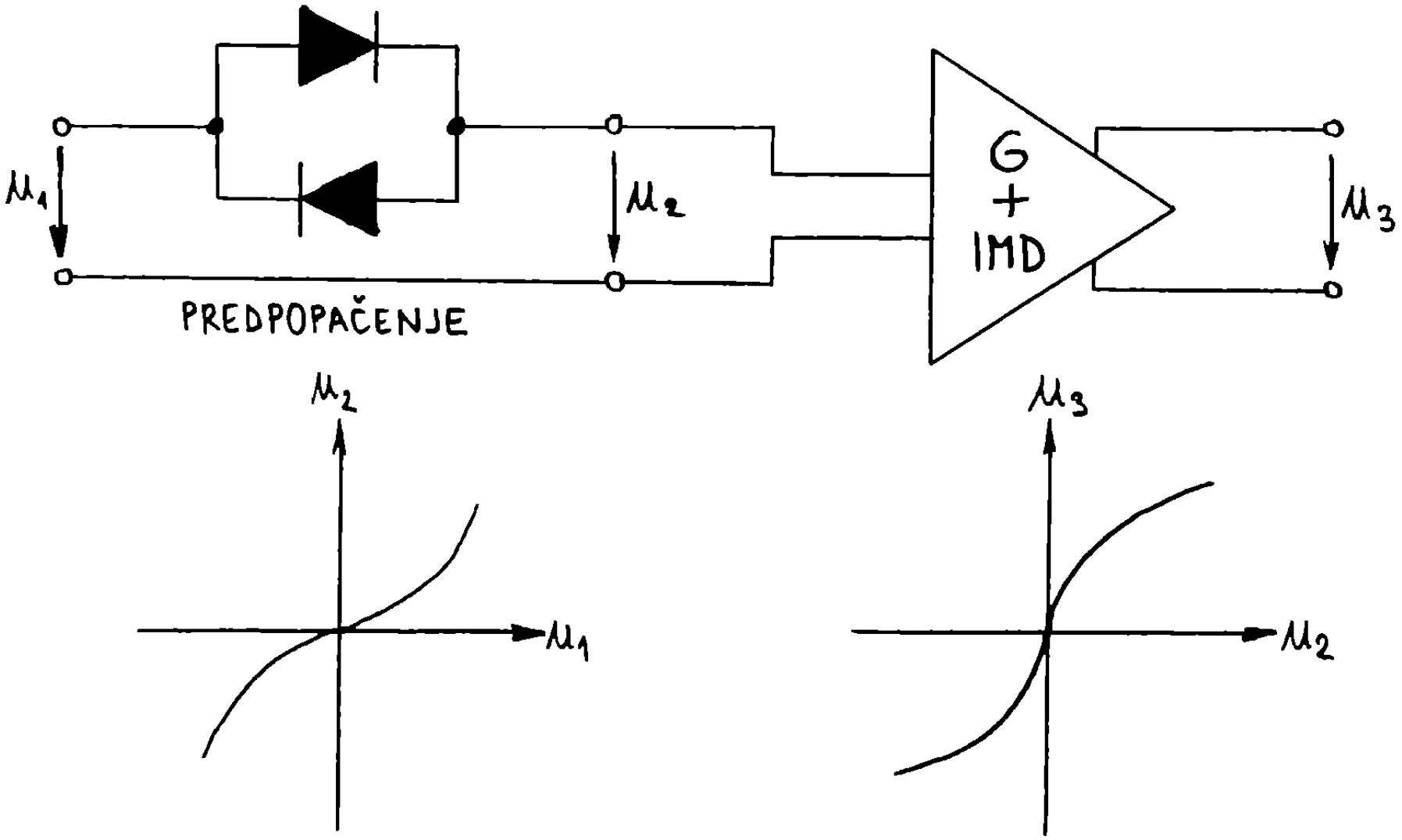

+Uc
+UB
IZHOD
VHOD
uBE
uCE

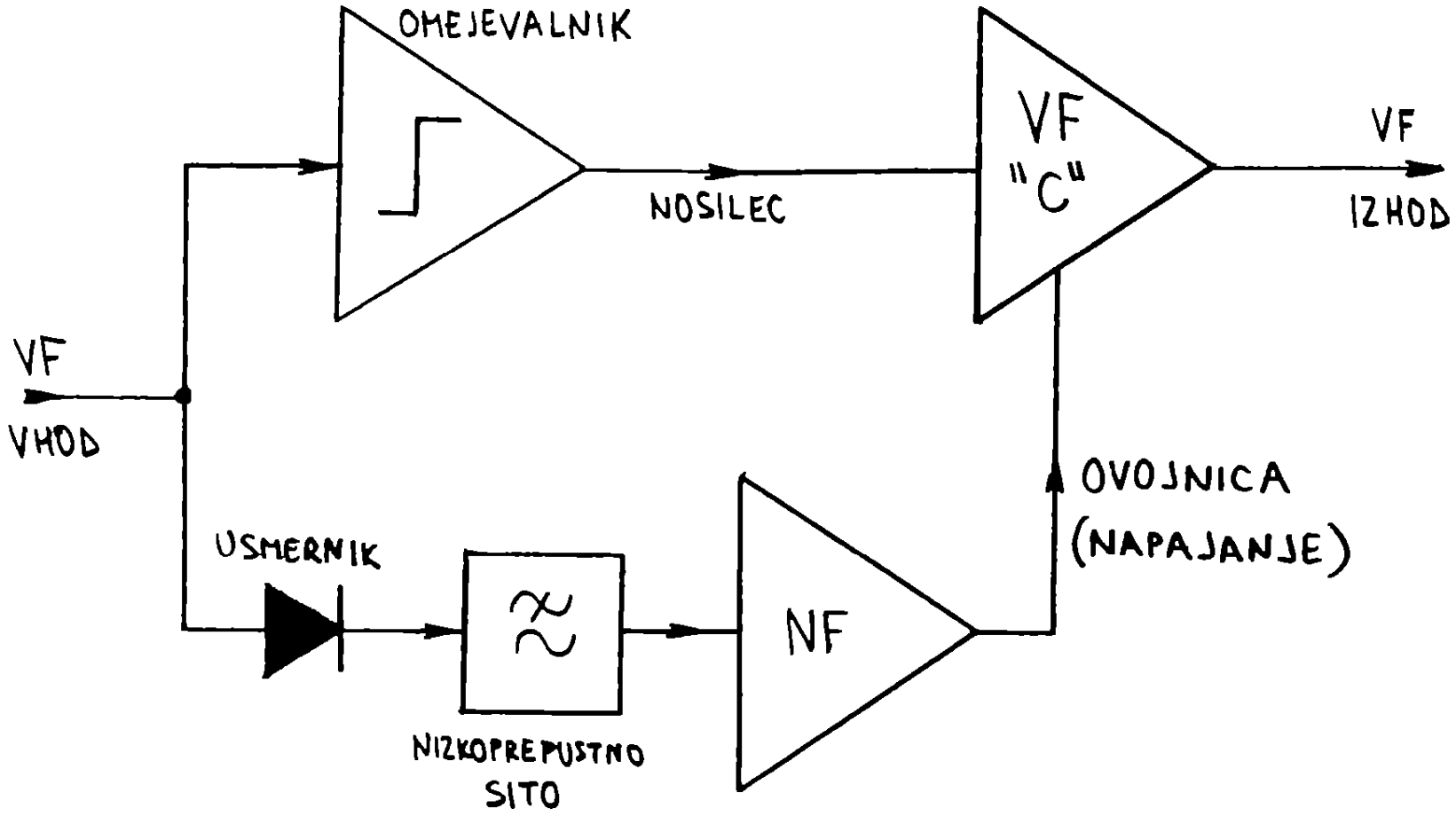

uCE
"B" RAZRED
+Uc
"C" RAZRED
"A" RAZRED
ZASIČENJE
uBE

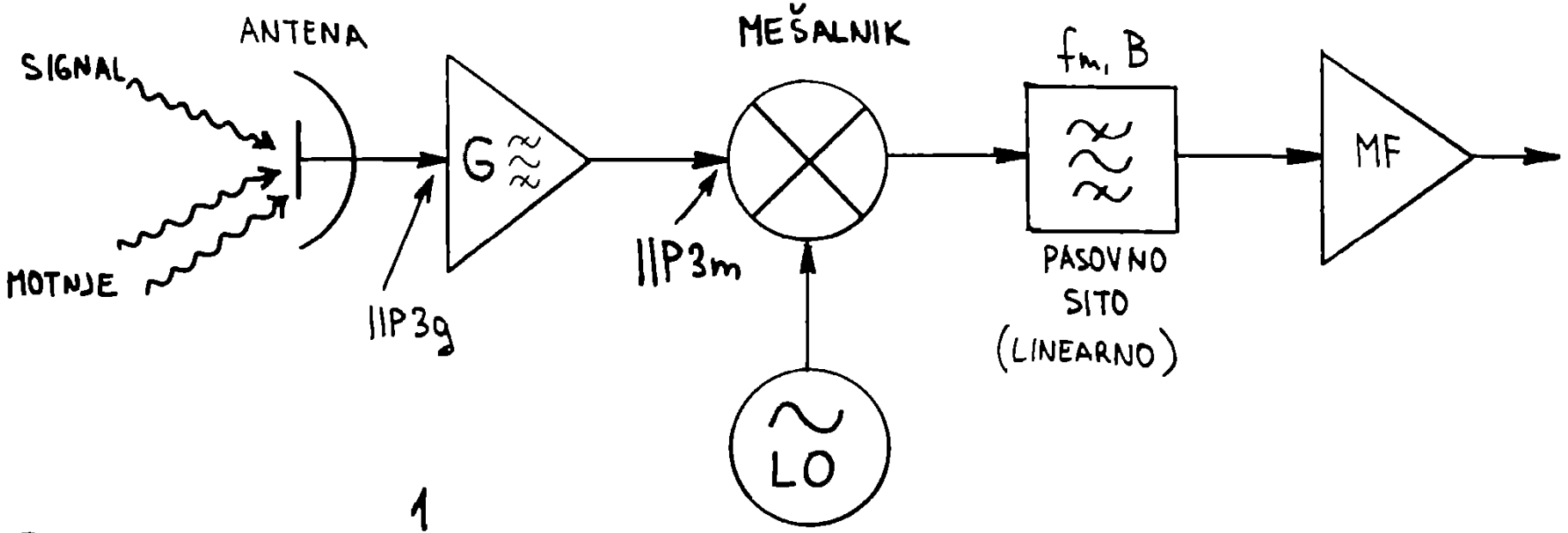


$$u_{CE} = C_0 + C_1 \cdot (u_{BE} - U_B) + C_2 \cdot (u_{BE} - U_B)^2 + C_4 (u_{BE} - U_B)^4 + \ldots$$


10log P [dBm]
IP3
P_{IP3}
P_{1dB}
$P_=$
$P_=$
$P_=$
1dB
P_{LIN}
P_{LIN}
P_{LIN}
P_{IMD3}
P_{IMD3}
P_{IMD3}
$tg\gamma = \frac{1}{2}$
$\gamma = 26.57°$
LINEARNO
PODROČJE
P_{VH}
"B"
P_{LIN}
P_{IMD3}
$P_=$
NAPAJANJE
$tg\beta = 3$
$\beta = 71.57°$
10log P_{VH}
[dBm]


u1
u2
G
+
IMD
u3
PREDPOPAČENJE
u2
u1
u3
u2


OMEJEVALNIK
NOSILEC
VF
"C"
VF
IZHOD
VF
VHOD
OVOJNICA
(NAPAJANJE)
USMERNIK
NF
NIZKOPREPUSTNO
SITO



$$P_{IIP3} = \frac{1}{\frac{1}{P_{IIP3g}} + \frac{G}{P_{IIP3m}}}$$