Prérequis

systèmes linéaires
transformée de Laplace, fonction de transfert
schéma blocs
réponse à un échelon

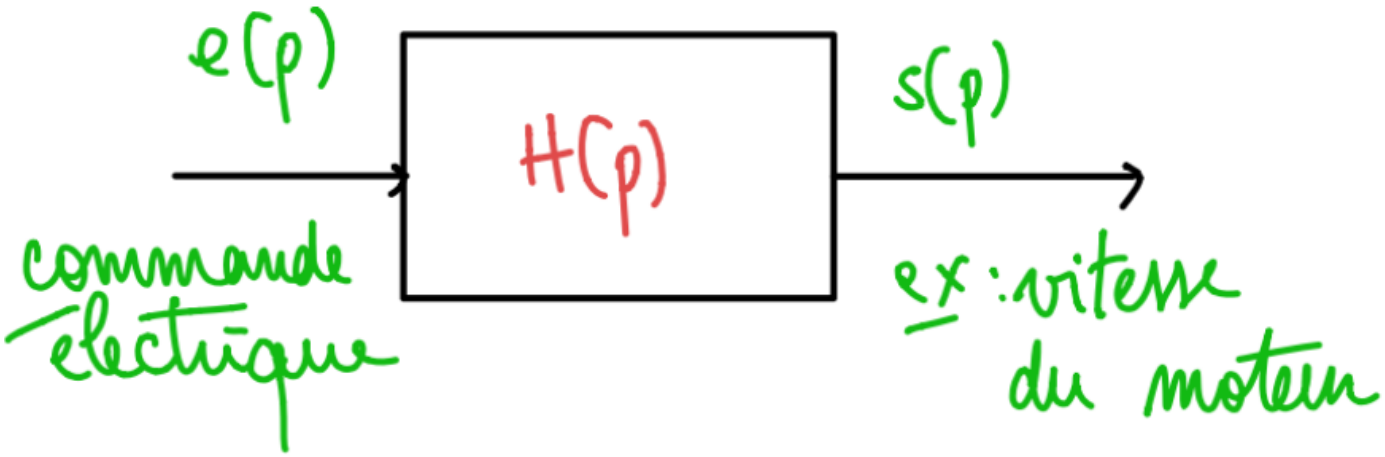
Plan

I/ Systèmes bouclés linéaire

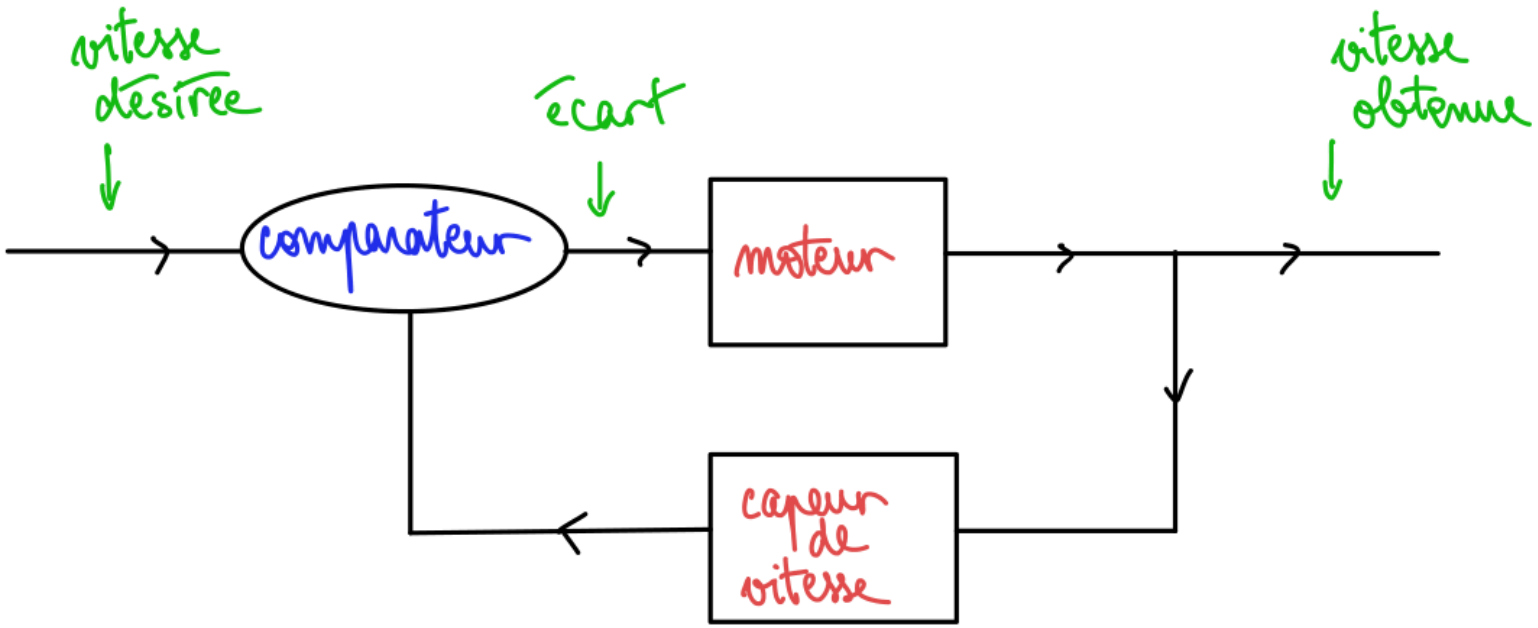
II/ Conséquences de la rétroaction

III/ Oscillateur: le LASER

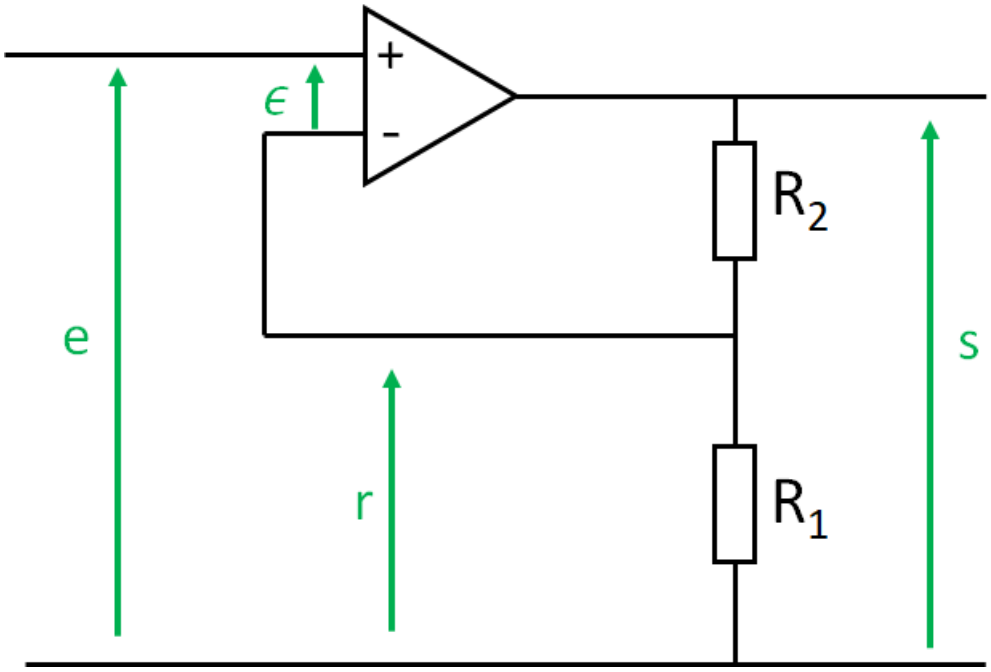
Schéma bloc d'un filtre linéaire



Exemple de rétroaction



Amplificateur non-inverseur



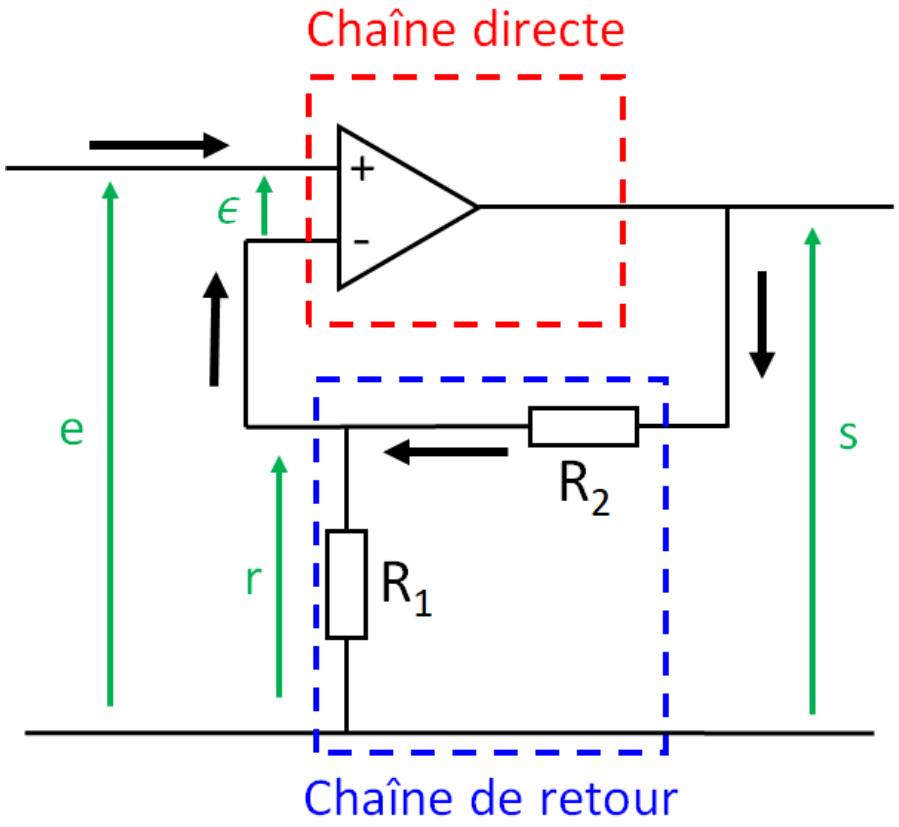
ALI : $s(p) = \frac{\mu_0}{1 + \frac{p}{\omega_{ALI}}} \left[e_+(p) - e_-(p) \right]$

ODG $\omega_{ALI} = 50$ rad/s

$\mu_0 = 2.10^5$

Source: B. Blancon

Amplificateur non-inverseur



→ : sens de circulation du signal

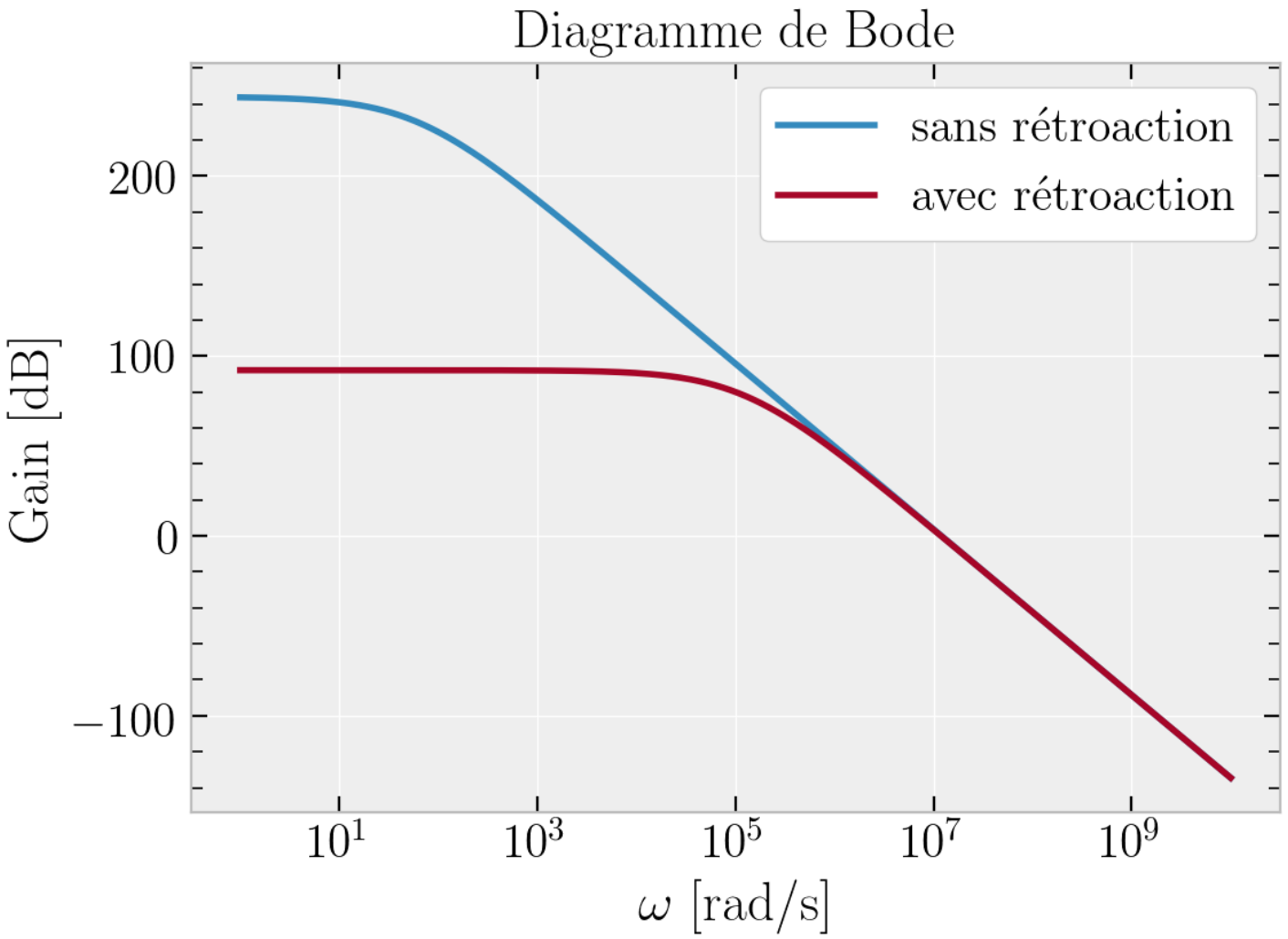
Source: B. Blancon

ALI : $S(p) = \frac{\mu_0}{1 + \frac{p}{\omega_{ALI}}} \left[e_+(p) - e_-(p) \right]$

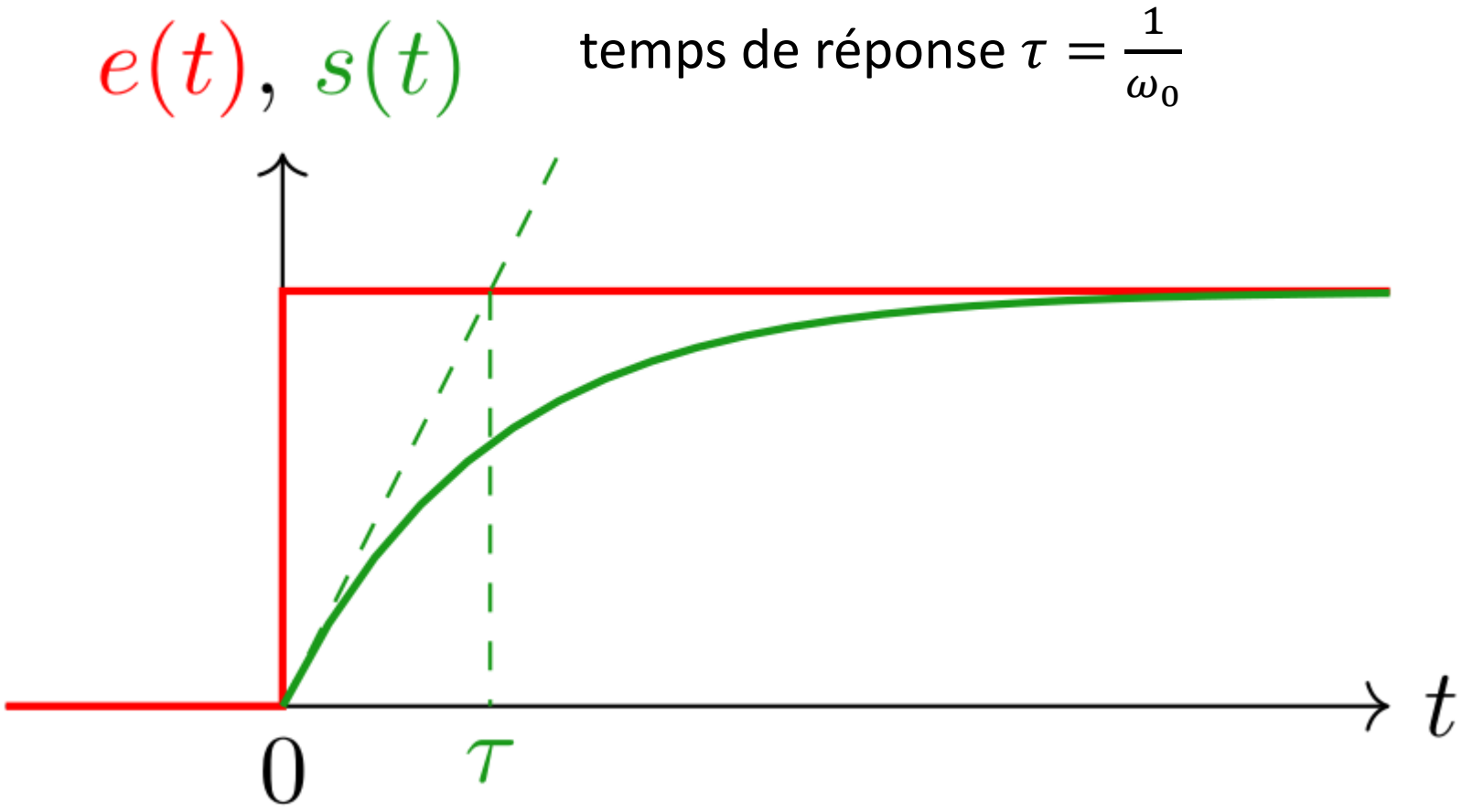
ODG $\omega_{ALI} = 50$ rad/s

$\mu_0 = 2.10^5$

Conservation du produit gain-bande



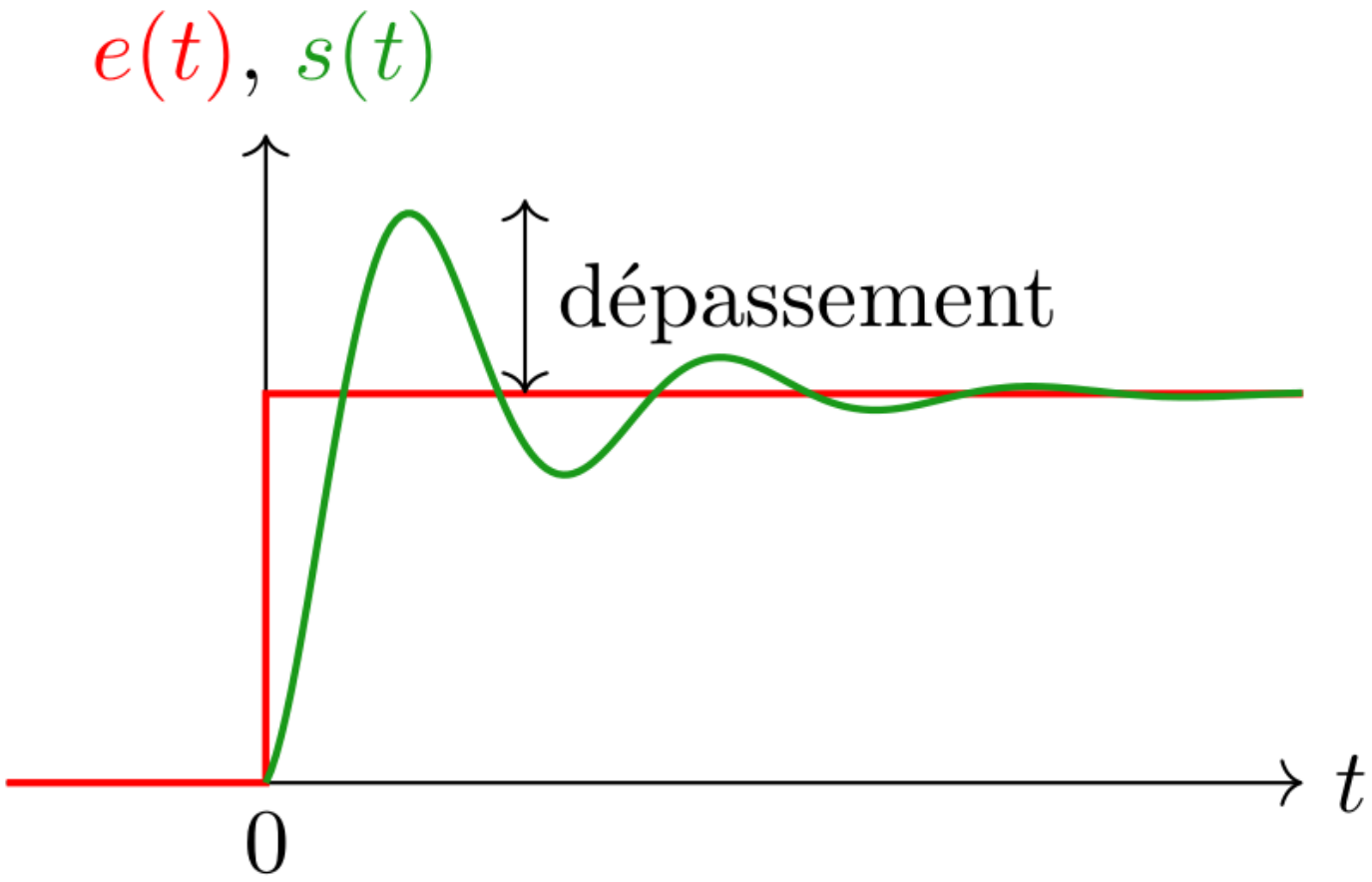
Réponse dynamique : système d'ordre 1



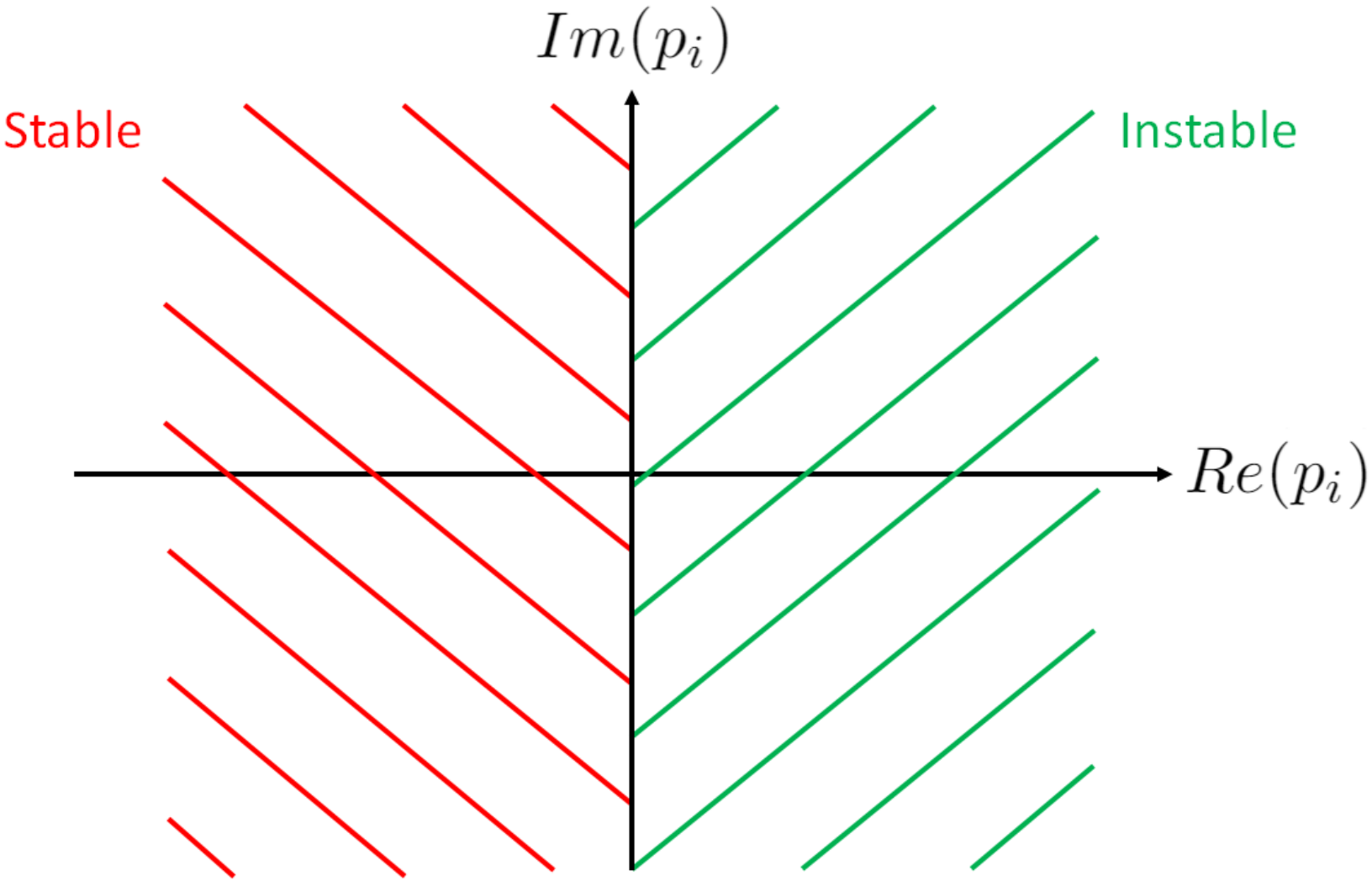
Source: B. Blancon

Réponse dynamique : système d'ordre 2

Dans un système d'ordre 2, il peut y avoir dépassement.



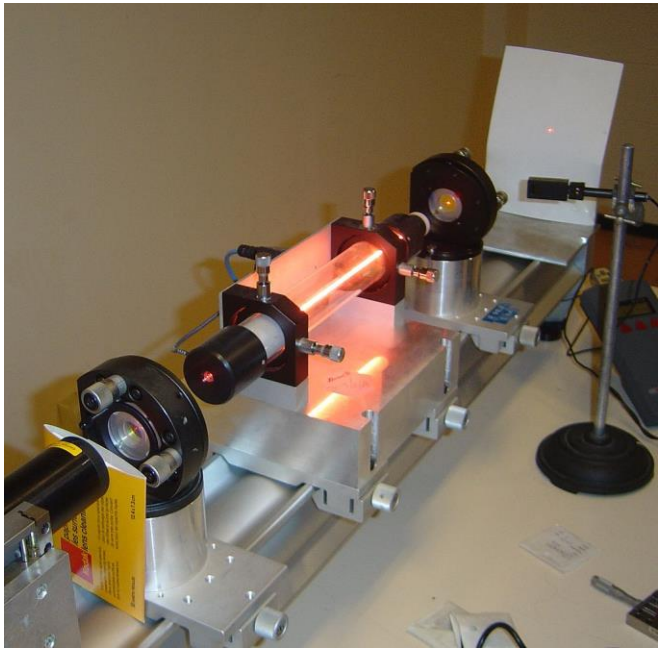
Source: B. Blancon



Source: B. Blancon

Schéma de principe d'un laser He-Ne

Laser He-Ne de démonstration au Laboratoire Kastler Brossel



Source: Wikipedia

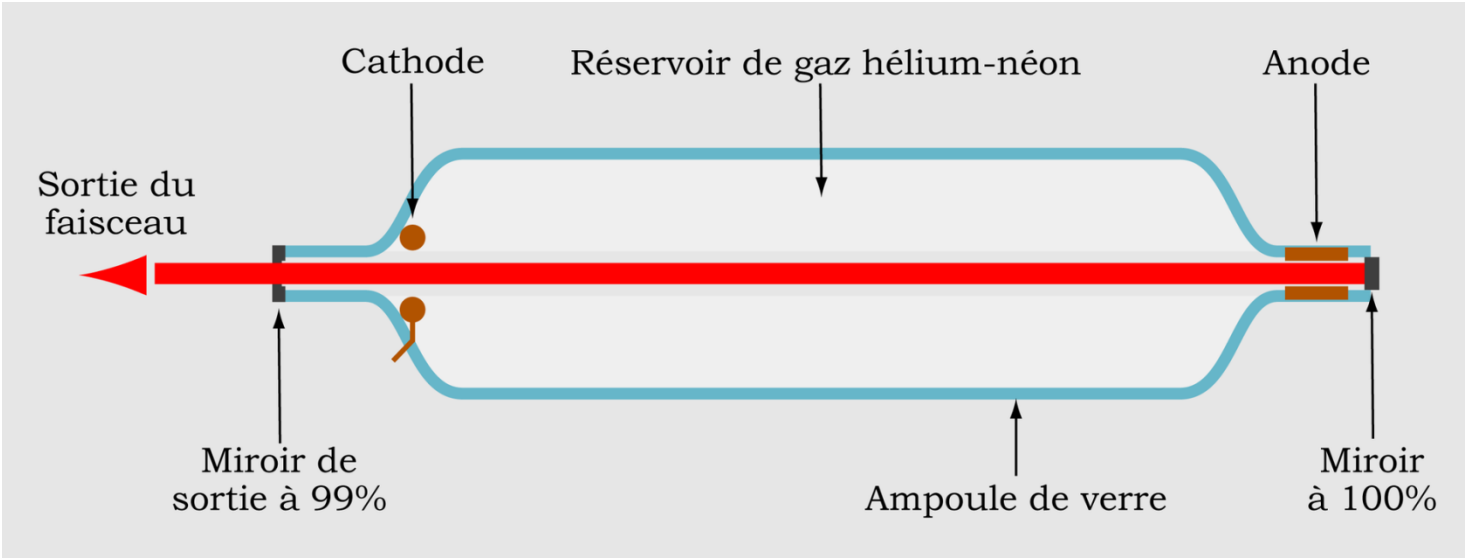
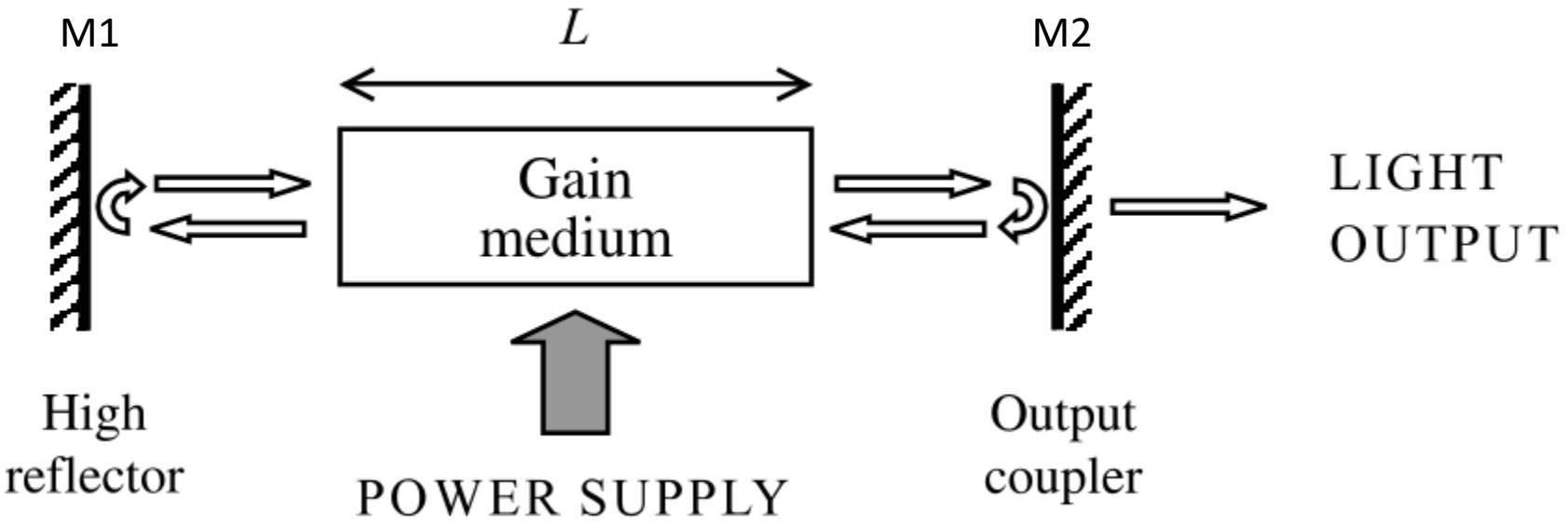
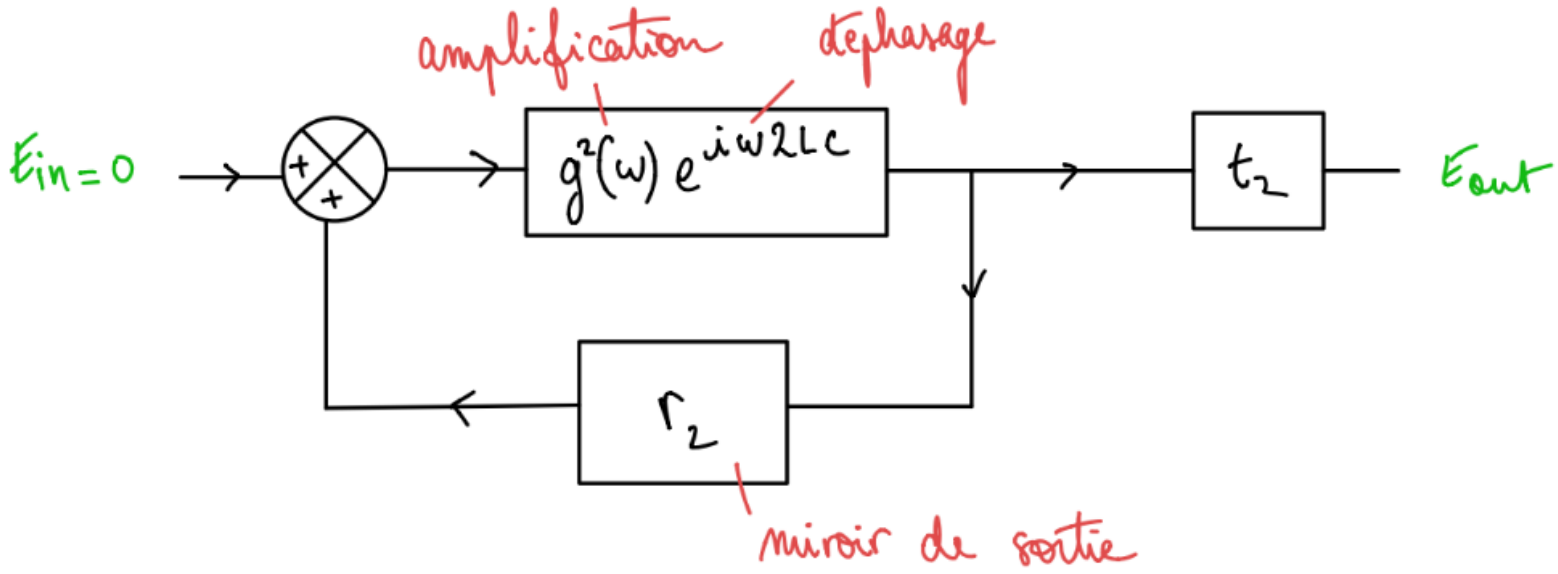


Schéma de principe d'un laser

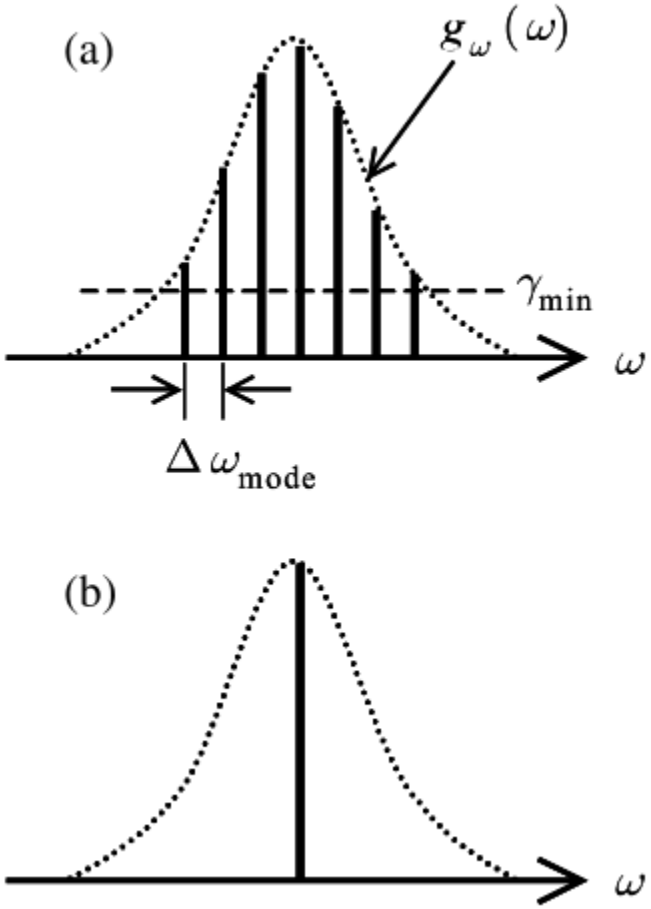


Source: Fox, Quantum optics

Schéma bloc d'un LASER

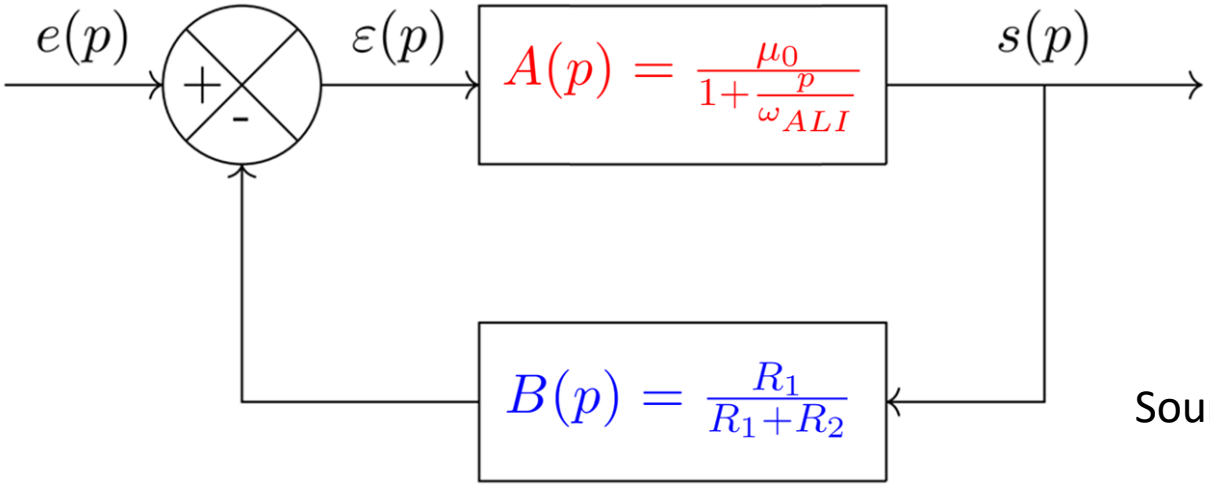


Représentation spectrale d'un LASER



Source: Fox, Quantum optics

Amplificateur non-inverseur



Source: B. Blancon

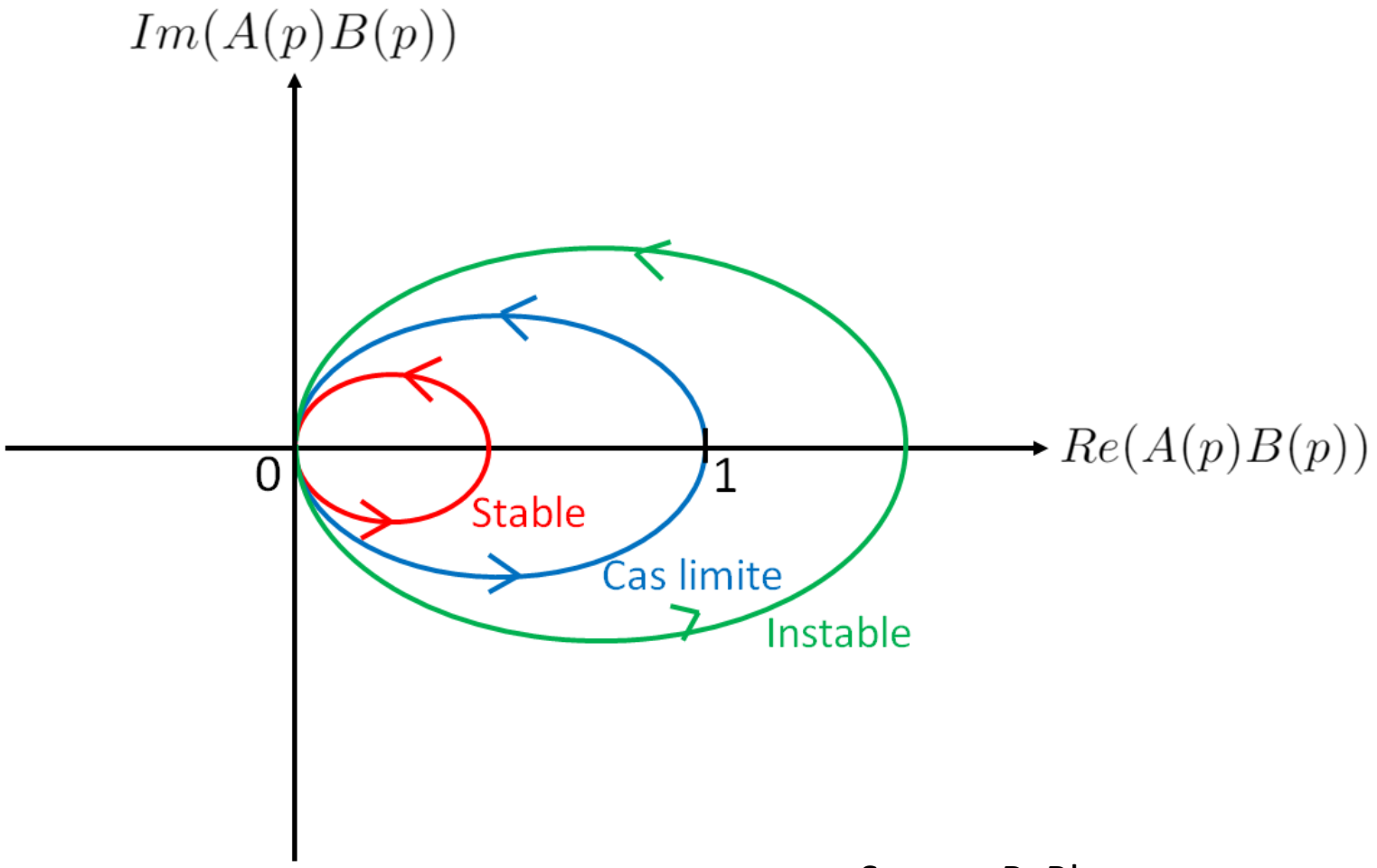
$$H(p) = \frac{A(p)}{1+A(p)B} = \frac{1}{\frac{1}{A(p)}+B} = \frac{1}{1+\frac{p}{\omega_{ALI}}+B}$$

$$= \frac{\mu_0}{1+B\mu_0+\frac{p}{\omega_{ALI}}} \quad \frac{\div(1+B\mu_0)}{\div(1+B\mu_0)} = \frac{\frac{\mu_0}{1+B\mu_0}}{1+\frac{p}{\omega_{ALI}(1+B\mu_0)}}$$

H_0 : $\frac{\mu_0}{1+B\mu_0}$

ω_0 : $\omega_{ALI}(1+B\mu_0)$

Critère du revers



Source: B. Blancon