# *Filtrage fréquentiel*

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***I(x,y)*** image originale

$$F(u,v) = TF[I(x,y)]$$

***R(x,y)*** image filtrée

$$G(u,v) = TF[R(x,y)]$$

multiplication
élément par élément

$$G(u,v) = H(u,v) \cdot F(u,v)$$

***H(u,v):*** *filtre*
*fonction de transfert du filtre*

***exemples:***

***Filtre passe-haut idéal***

$$H(u,v) = \begin{cases} 0 & si\ D(u,v) < D_0 \\ 1 & si\ D(u,v) \geq D_0 \end{cases}$$

***Filtre passe-bas idéal***

$$H(u,v) = \begin{cases} 1 & si\ D(u,v) < D_0 \\ 0 & si\ D(u,v) \geq D_0 \end{cases}$$

*Image originale*


*Spectre d'amplitude*

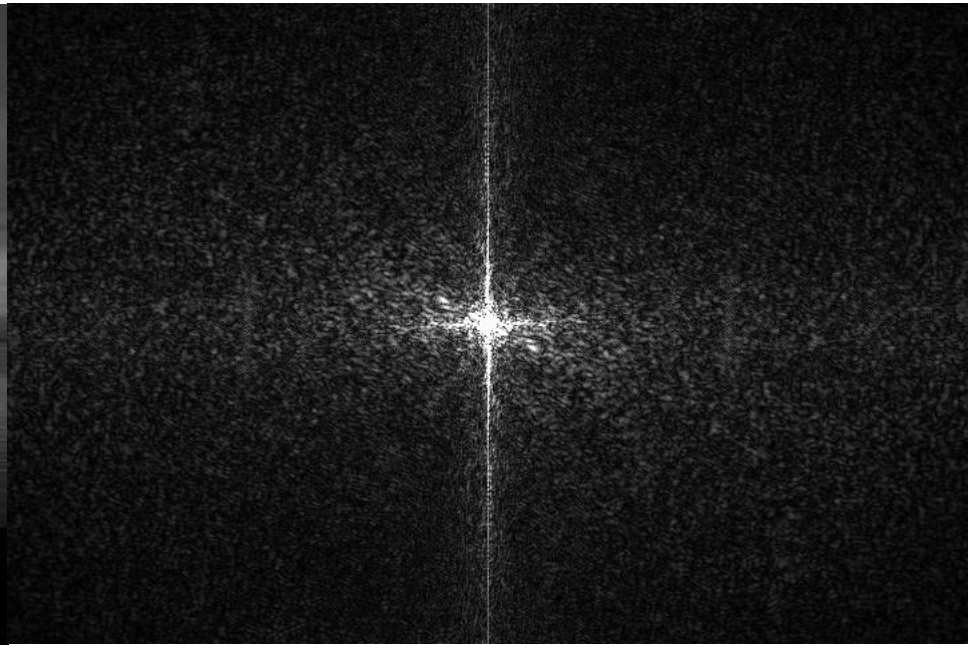
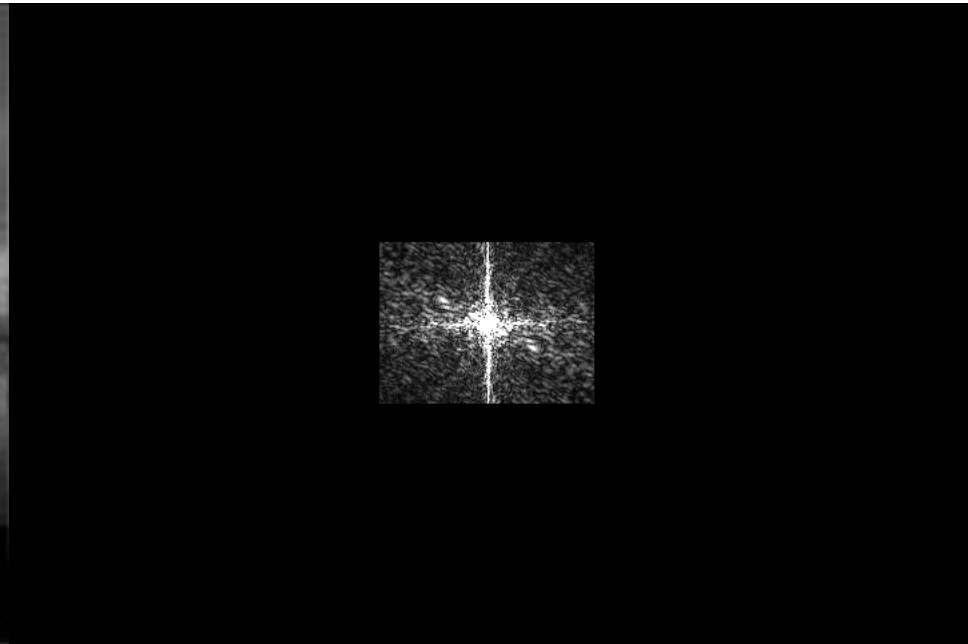


*Image filtrée*

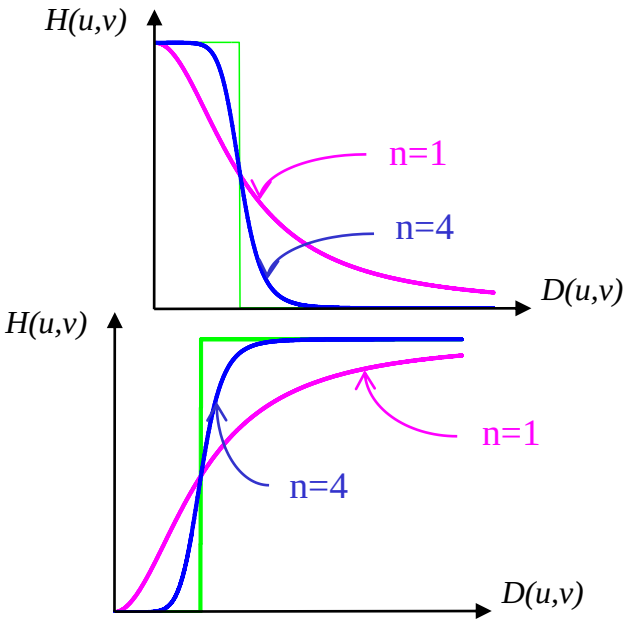
*filtre «passe-bas »*



## *Filtres de Butterworth:*

***passe-bas:*** $$H(u,v)=\frac{1}{1+\left(D(u,v)/D_0\right)^{2n}}$$

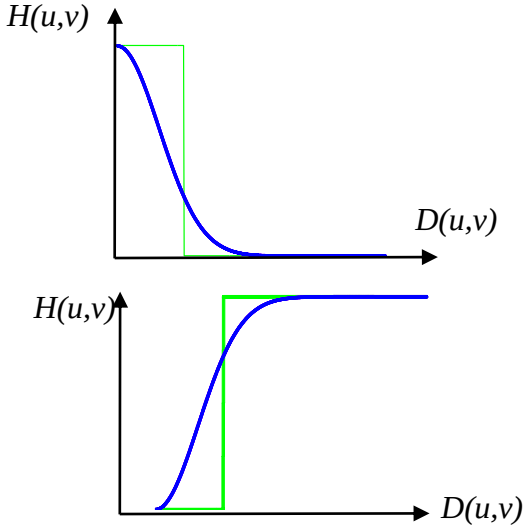
***passe-haut:*** $$H(u,v)=\frac{1}{1+\left(D_0/D(u,v)\right)^{2n}}$$




## *Filtres gaussiens:*

***passe-bas:*** $$H(u,v)=e^{-D^2(u,v)/2D_0^2}$$

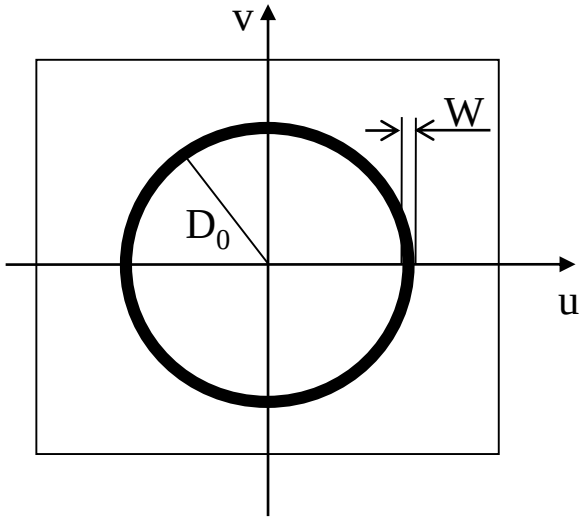
***passe-haut:*** $$H(u,v)=1-e^{-D^2(u,v)/2D_0^2}$$



# *Filtres « rejet de bande »*

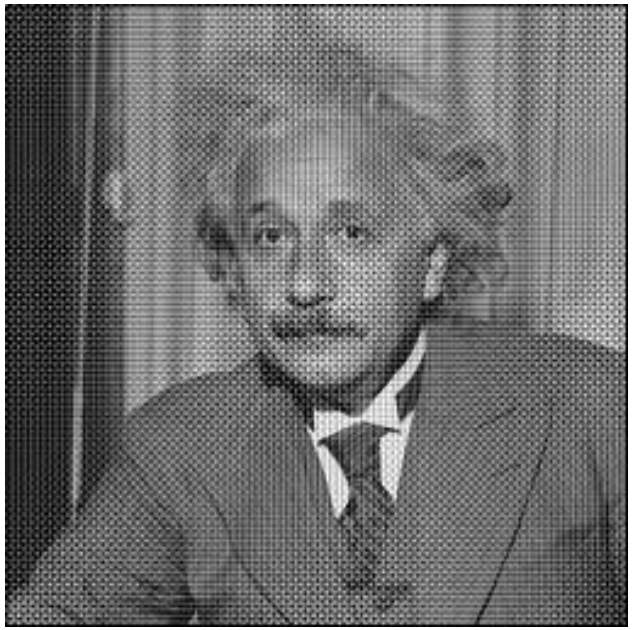
***idéal:***
$$H(u,v)=\begin{cases}1 & si\ D(u,v) < D_0 - \dfrac{W}{2} \\ 0 & si\ D_0 - \dfrac{W}{2} \le D(u,v) \le D_0 + \dfrac{W}{2} \\ 1 & si\ D_0 - \dfrac{W}{2} < D(u,v)\end{cases}$$

***Butterworth:***
$$H(u,v)=\frac{1}{1+\left[\dfrac{D(u,v)W}{D^2(u,v)-D_0^2}\right]^{2n}}$$




***gaussien:***
$$H(u,v)=1-e^{-\frac{1}{2}\left[\frac{D^2(u,v)-D_0^2}{D(u,v)W}\right]}$$

*Image bruitée*



*Spectre d'amplitude*

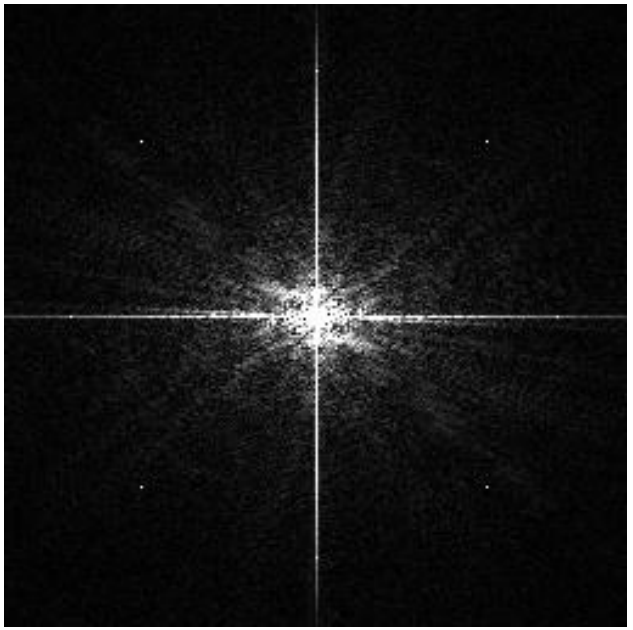
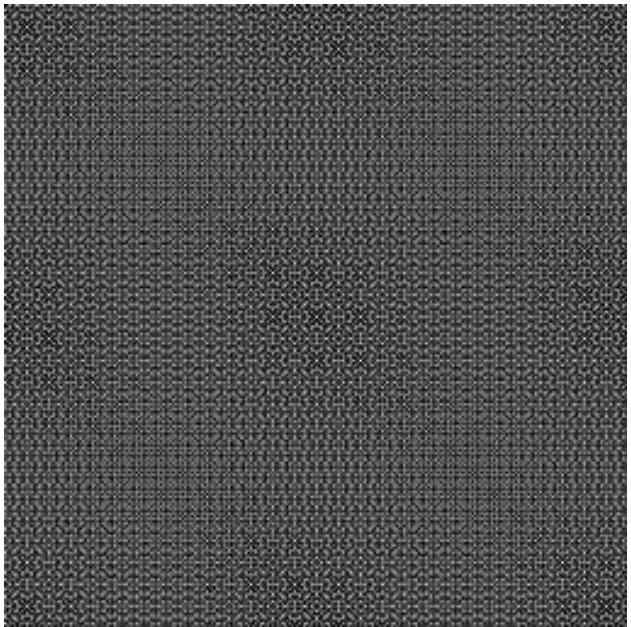


*Image du bruit*



*Spectre du bruit*

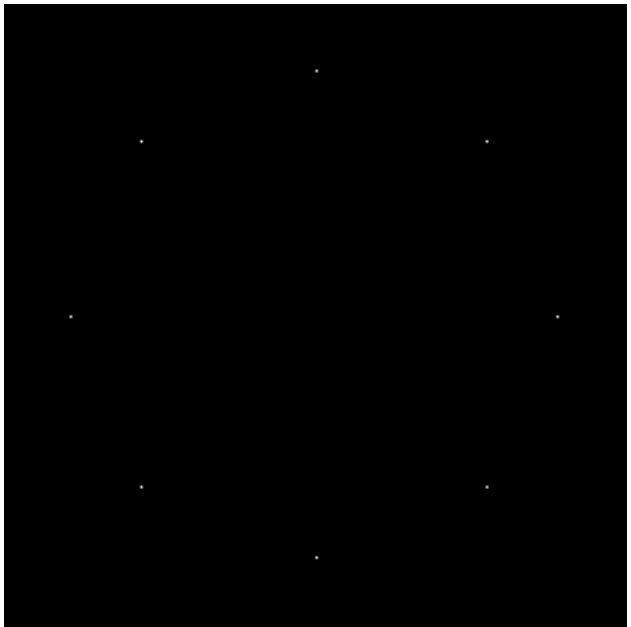


*Image bruitée*

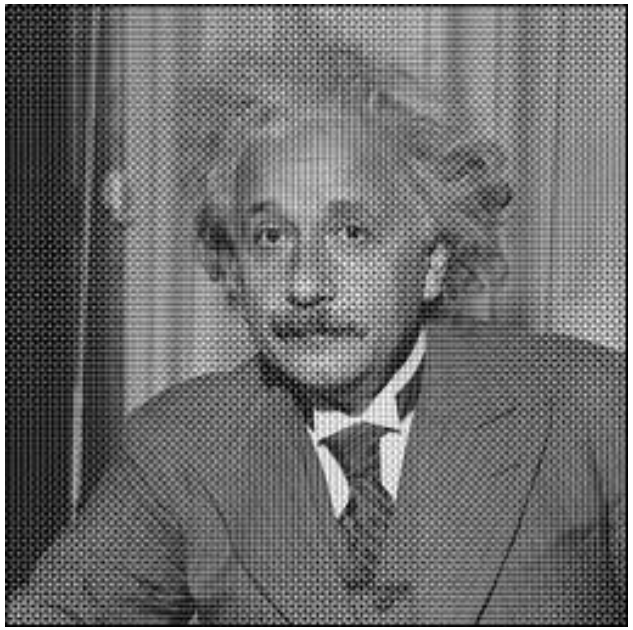
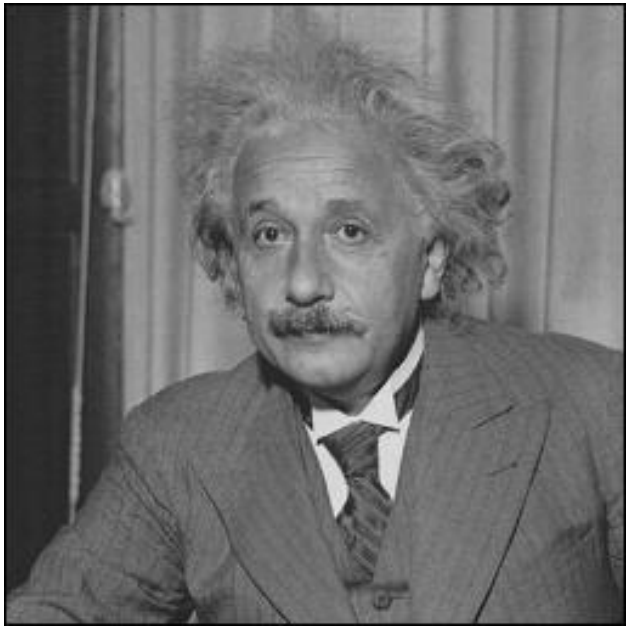


*Image originale*



*Spectre filtré*

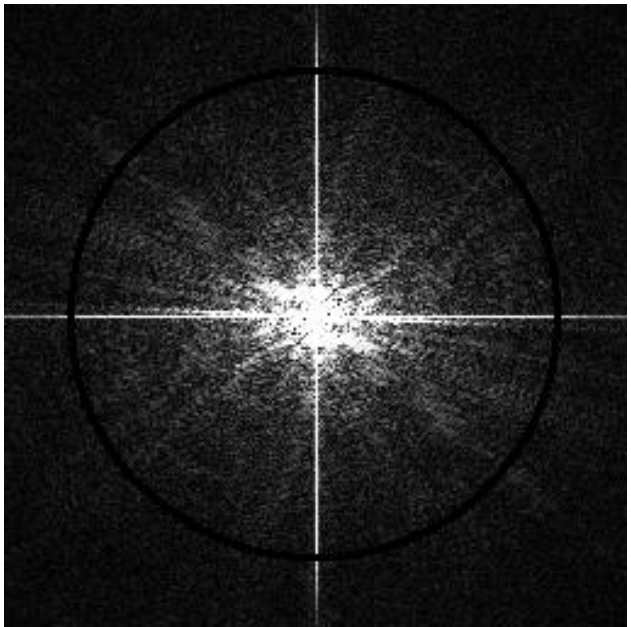


*Image filtrée*