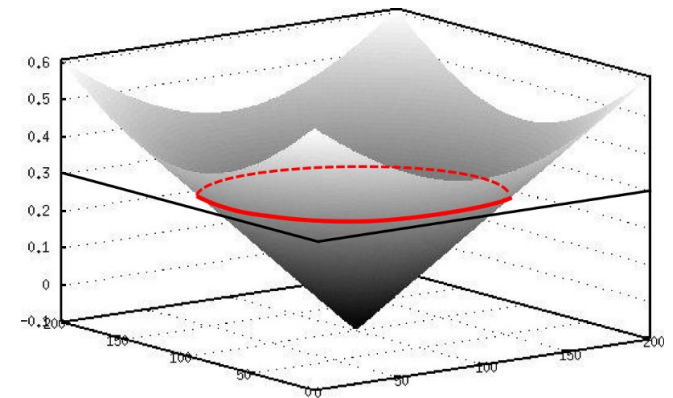


# Fonctions Implicites et Level Sets

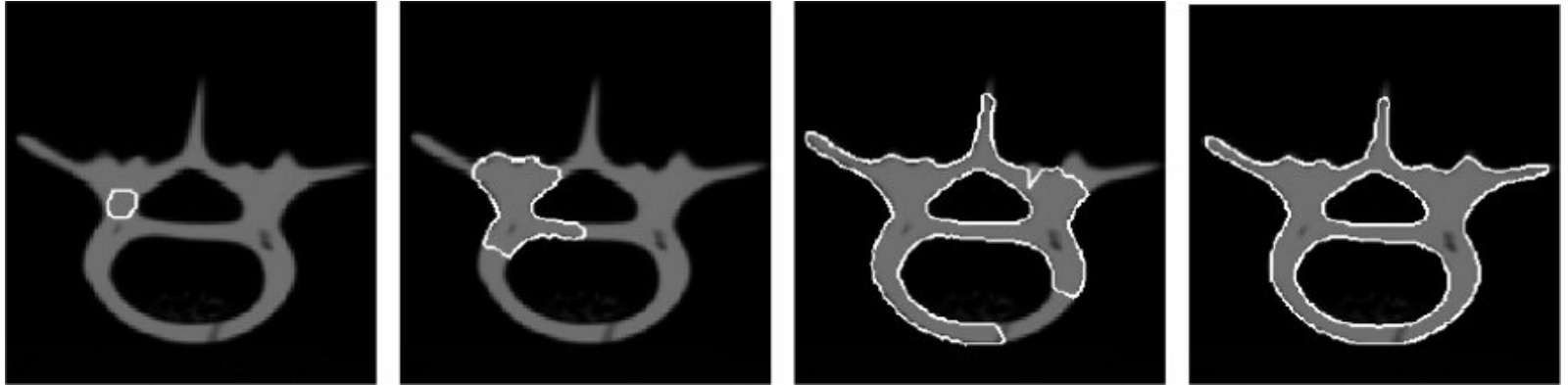
4ETI CPE, 2011/2012



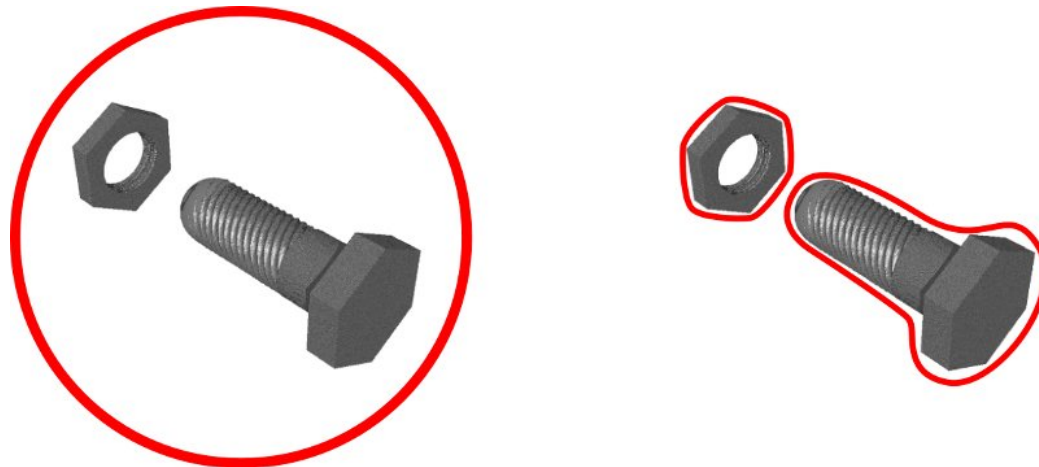
# Motivation :

## Changement de topologie

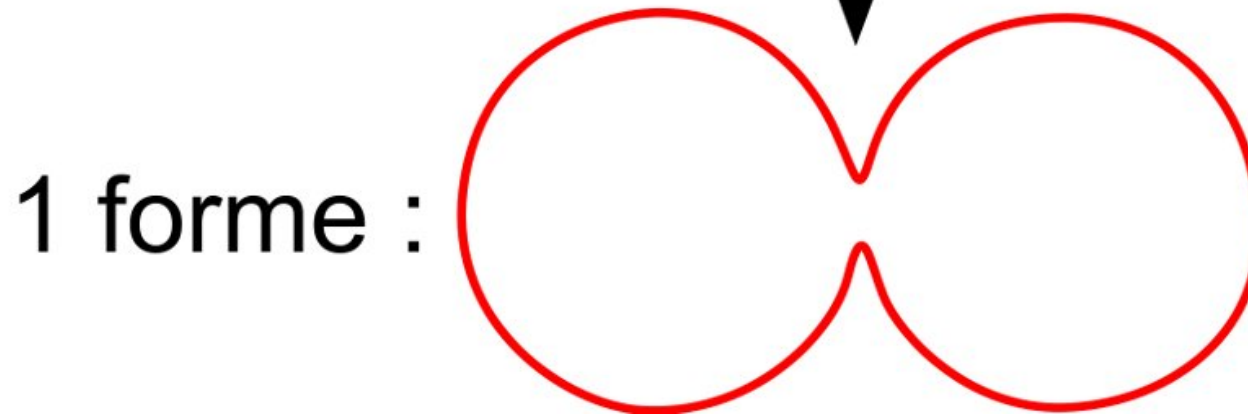
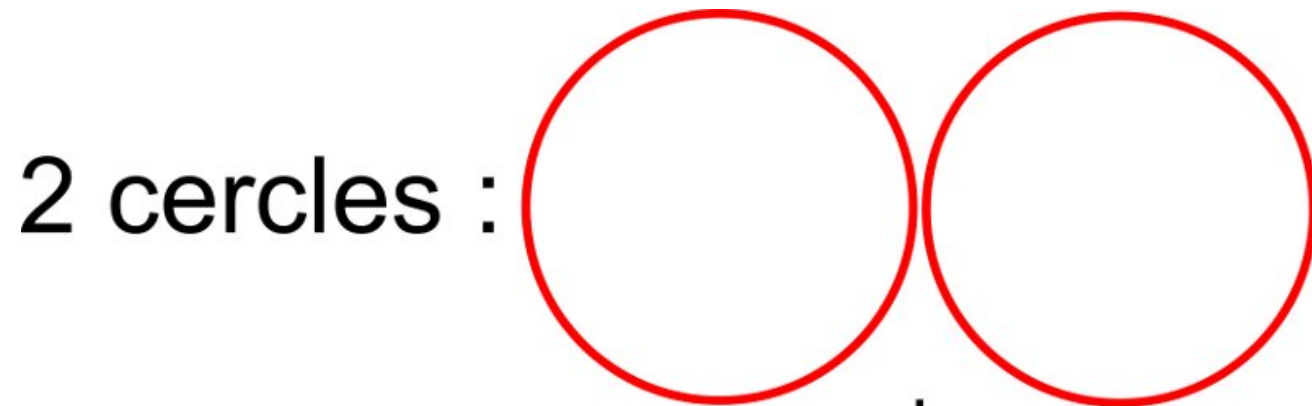
- Fusion :



- Splitting :



# Problématique à résoudre

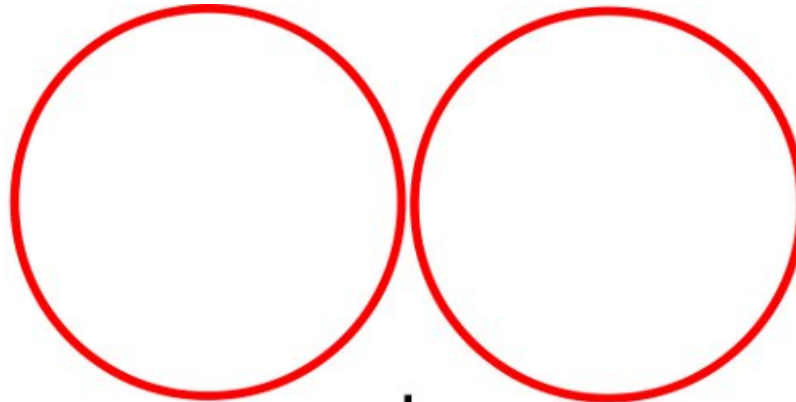


# Problématique à résoudre : Courbe explicite ?

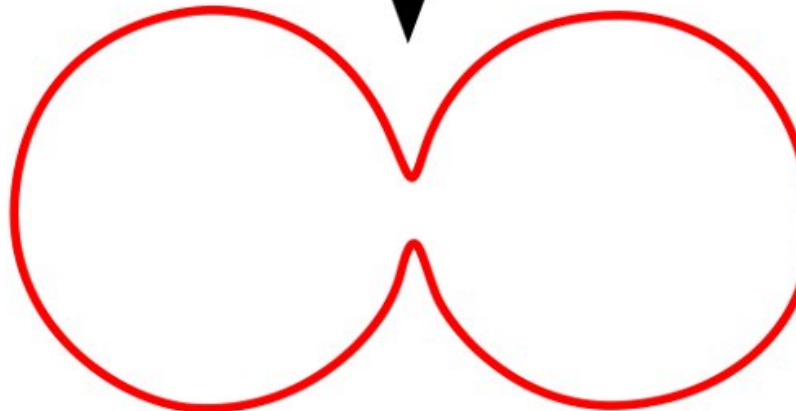
$$\begin{aligned}x(t) &= r_1 \cos(t) + x_1 \\ y(t) &= r_1 \sin(t) + y_1\end{aligned}$$

$$\begin{aligned}x(t') &= r_2 \cos(t') + x_2 \\ y(t') &= r_2 \sin(t') + y_2\end{aligned}$$

2 cercles :



1 forme :



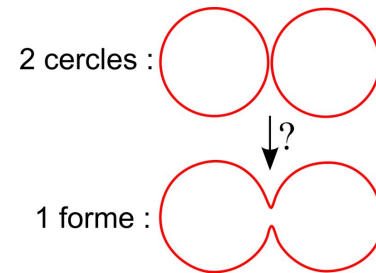
$$\begin{aligned}x(t'') &= ??? \\ y(t'') &= ???\end{aligned}$$

# Problématique à résoudre : Courbe explicite ?

Représentation **explicite** non adaptée  
aux **changements de topologies**

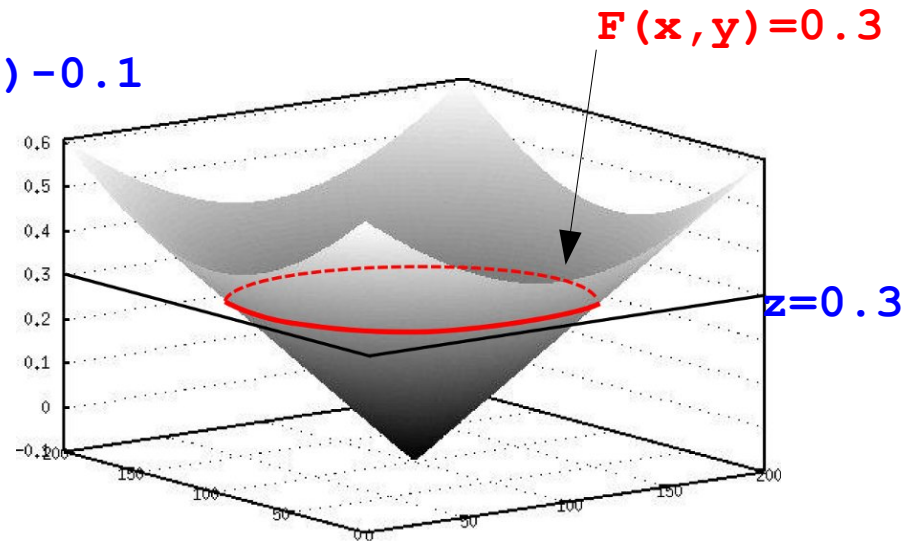
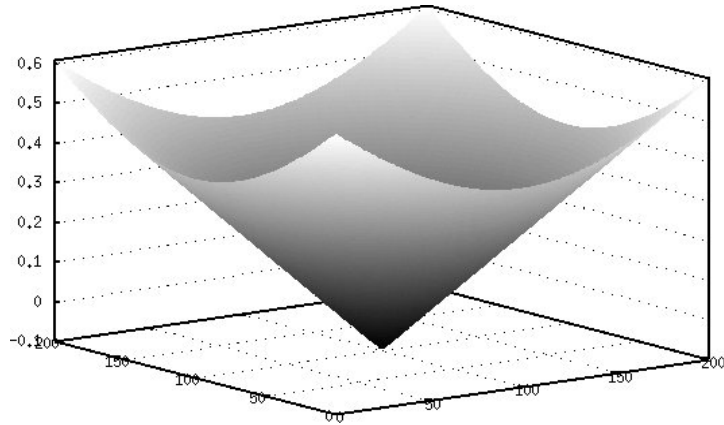
$$x(t) = ?$$

$$y(t) = ?$$

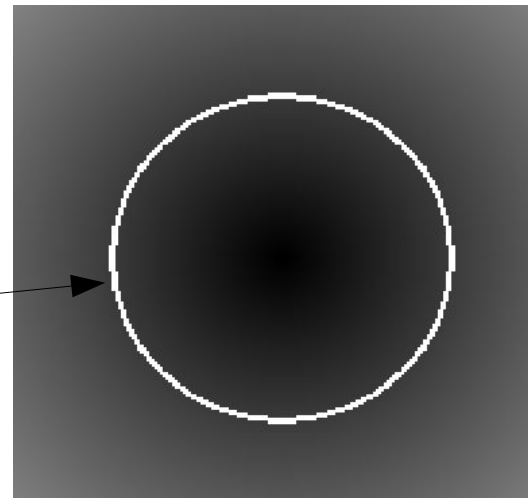


# Changement topologie : Fonction implicite

$$F(x, y) = \sqrt{(x-x_0)^2 + (y-y_0)^2} - 0.1$$



$$F(x, y) = 0.3$$

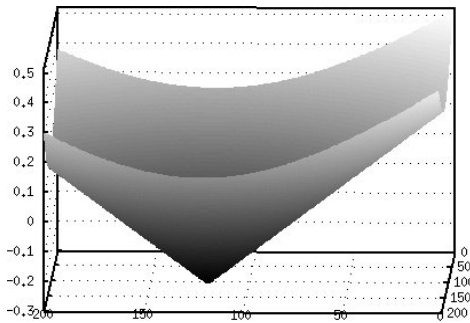


# Mélange de fonctions

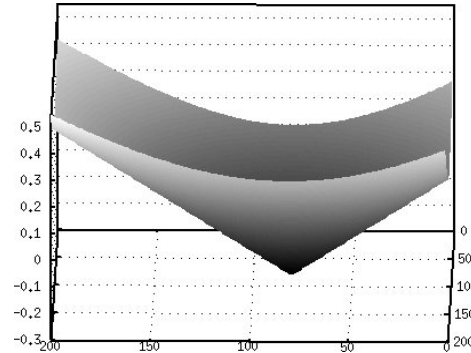
$$F1(x,y) = \sqrt{(x-x1)^2 + (y-y1)^2} - 0.1$$

$$F2(x,y) = \sqrt{(x-x2)^2 + (y-y2)^2} - 0.1$$

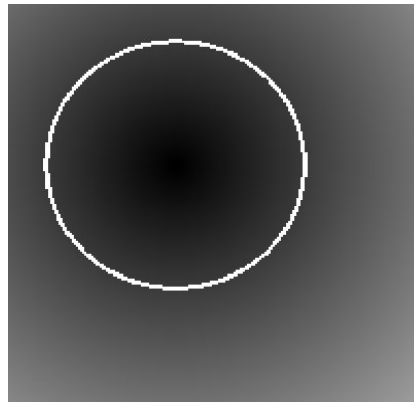
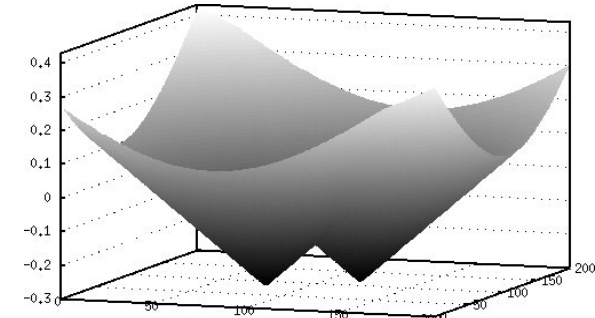
F1



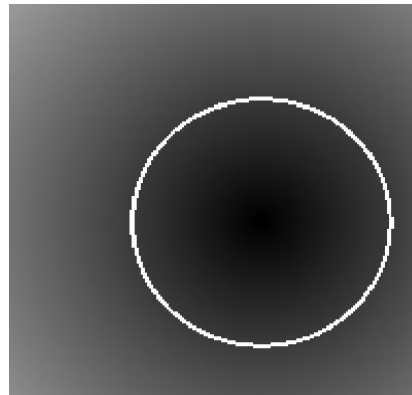
F2



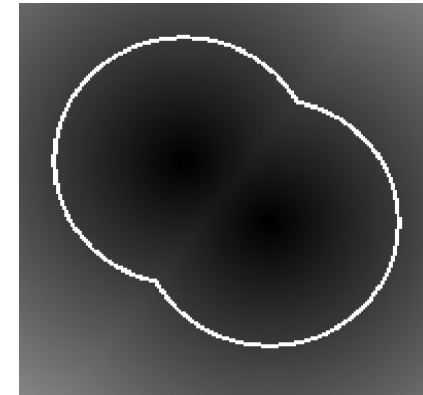
F1+F2



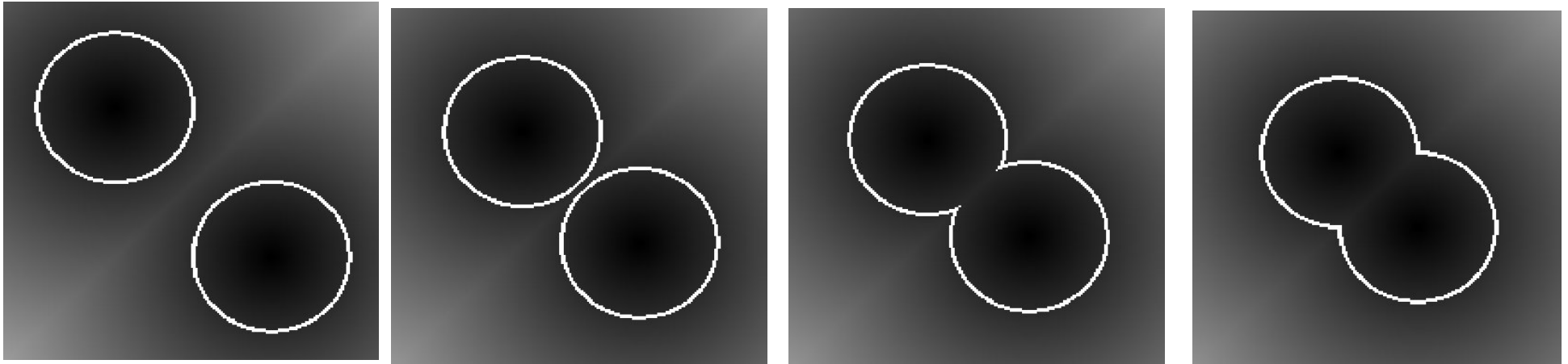
+



=



# Modification de topologie

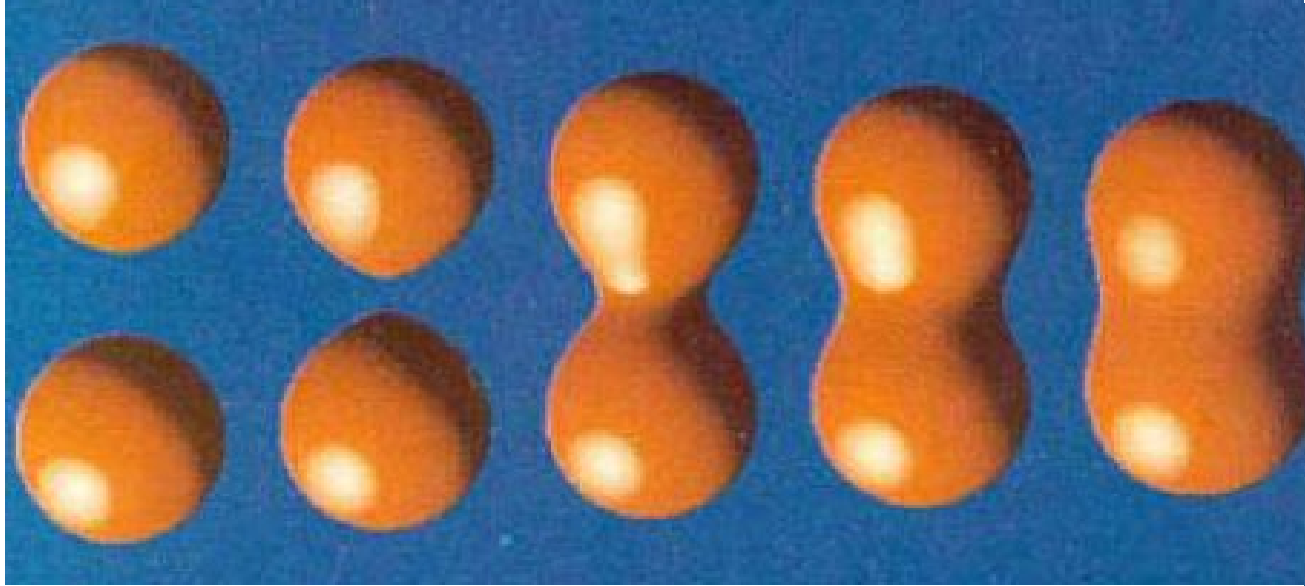


*Différentes topologies en fonction du choix des centres  
( $x_1, y_1$ ) et ( $x_2, y_2$ )*

---



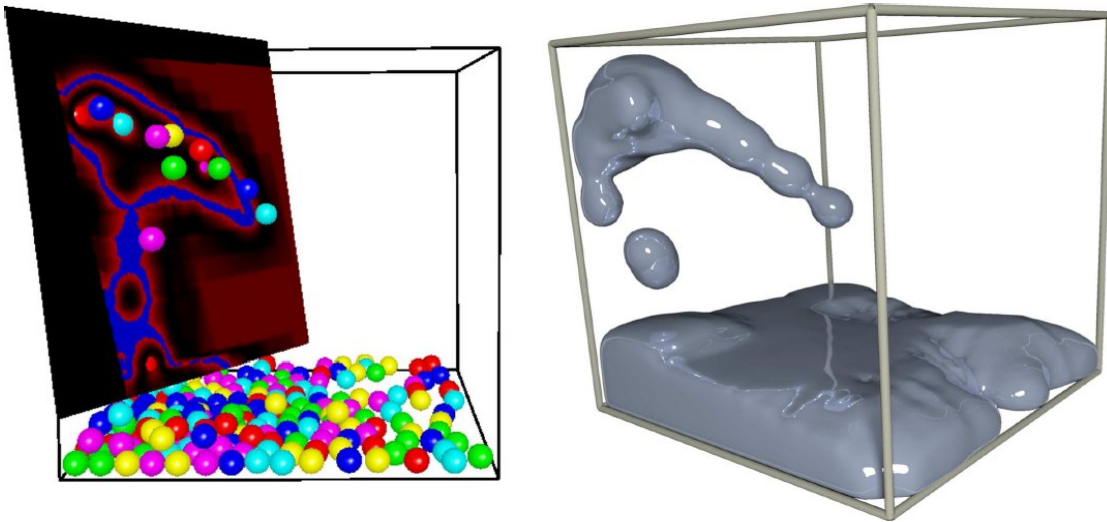
# Modification de topologie (3D)



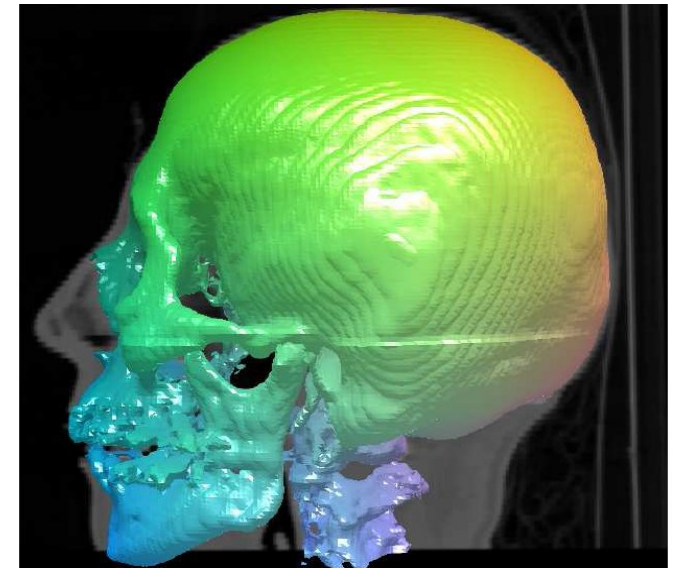
Fonction :  $F(x, y, z) = \text{valeur}$

---

# Utilisation fonctions implicites



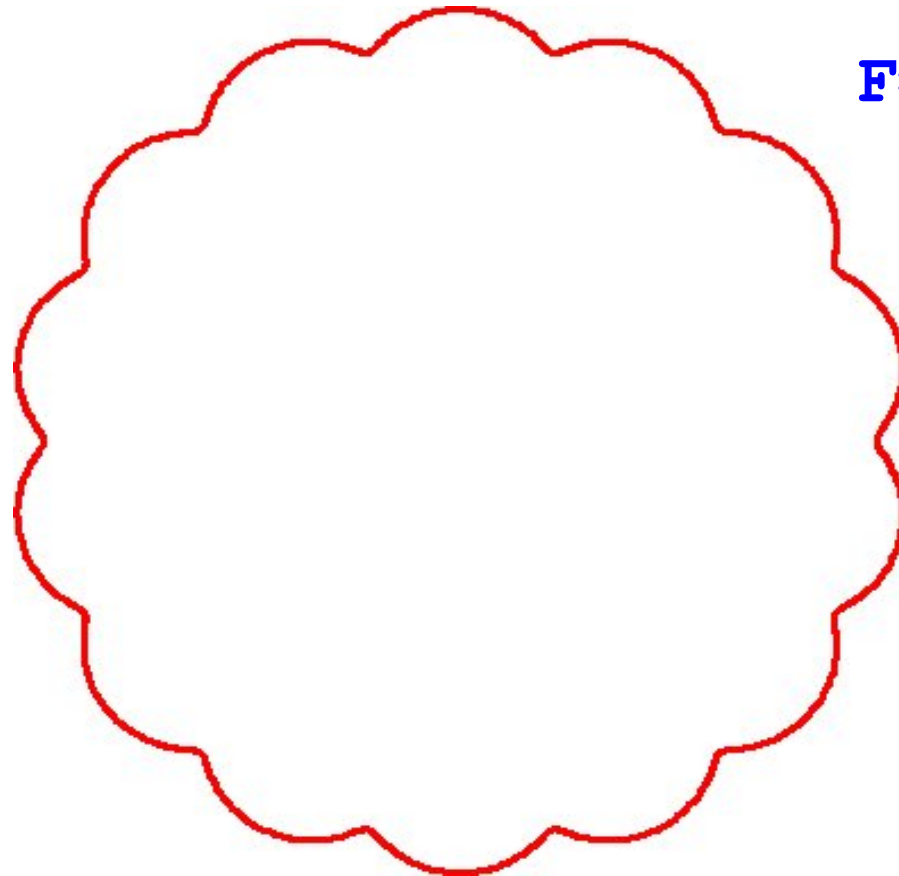
*Visualisation de fluide*



*Imagerie scanner*

# Cas des courbes quelconques

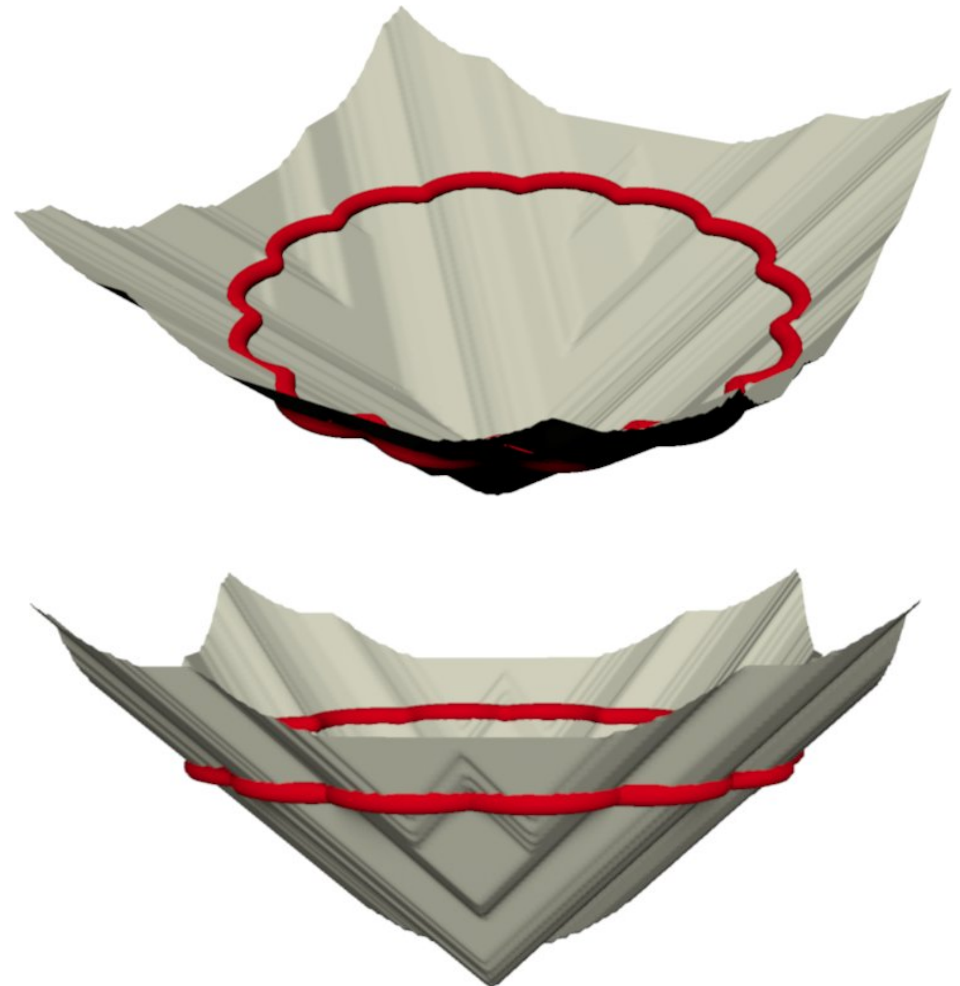
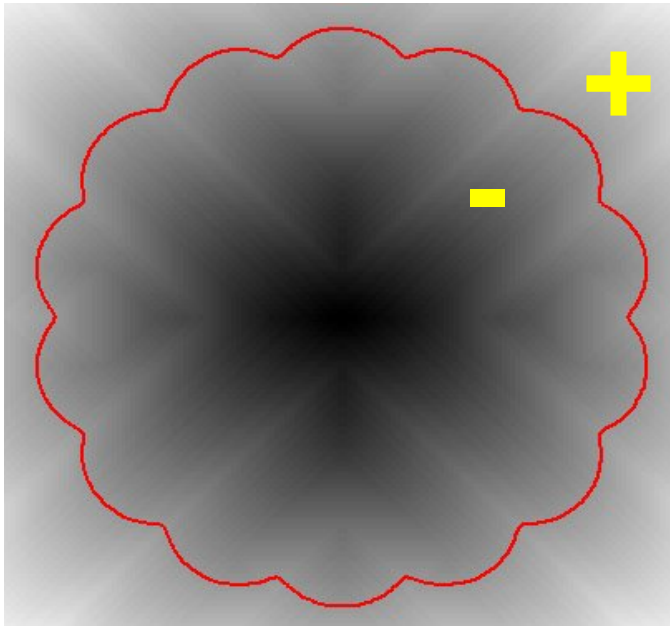
Quelle fonction  $F$  choisir ?



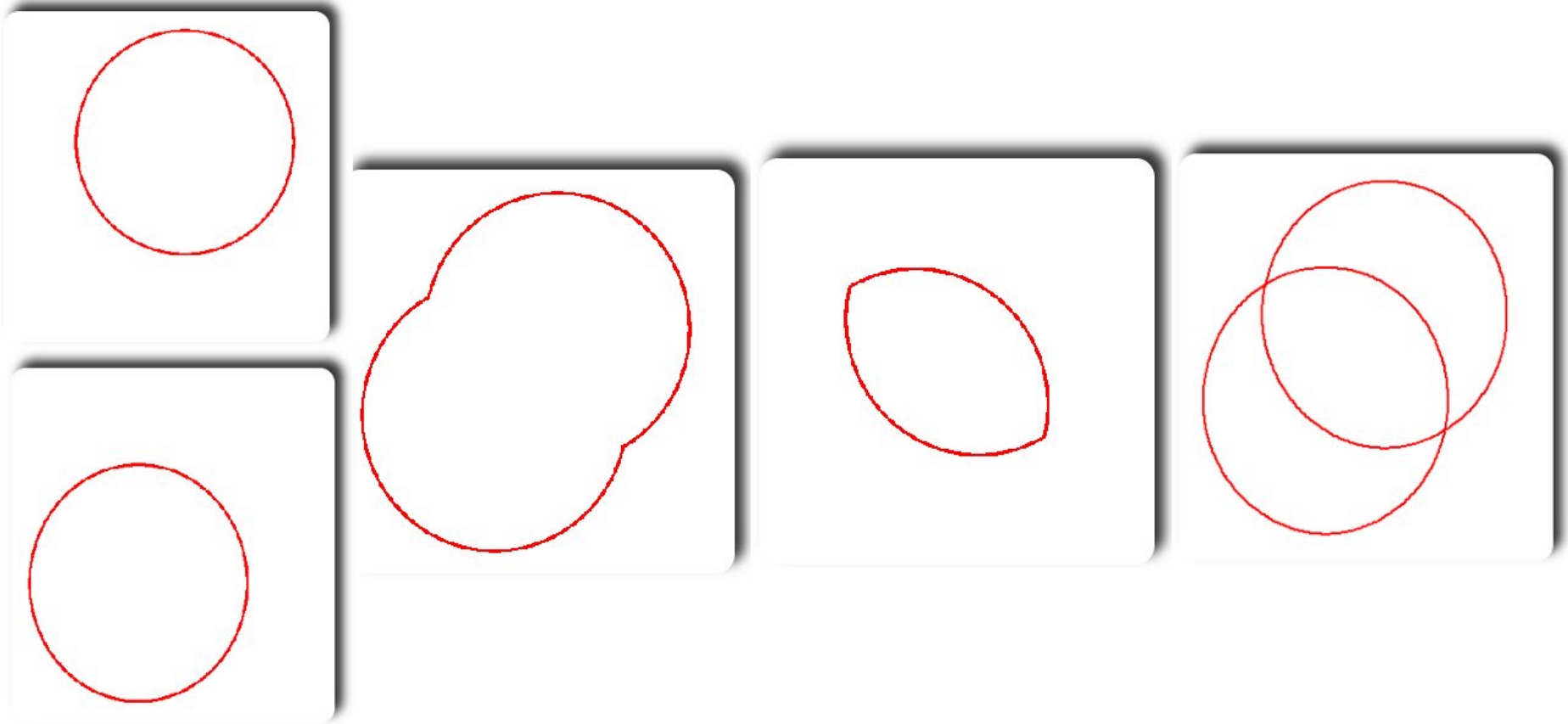
$F = ?$

# Cas des courbes quelconques

Pour une courbe donnée :  
 $F$  = Fonction de distance signée



# Opérateurs de mélanges



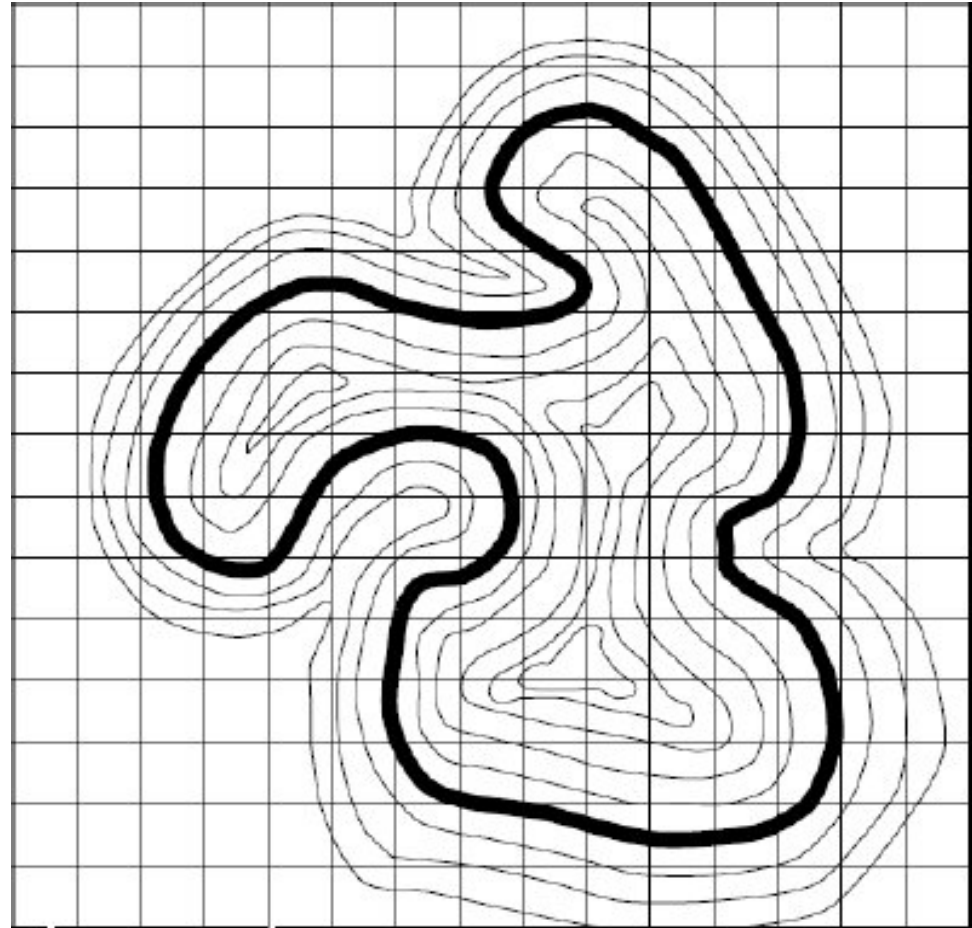
*Fonctions simples  $\Rightarrow$  Transformations **topologiques***

*Equation explicite correspondante complexe*

---

# Déformation de courbe

Courbe :  $C = F^{-1}(x, y)$



Si on fait évoluer  $F$ , on fait évoluer  $C$

---

# But levels sets

Pour modifier C, on vient modifier F

Comment modifier F pour obtenir l'effet souhaité sur C ?

---