Non linear model.

$$-\operatorname{div}(\lambda(u)\nabla u) + w\cdot\nabla u = f \quad \text{in } \Omega$$

$$-\lambda(u)\,\partial_n u = \begin{cases} cu & \Gamma_{out} \\ 0 & \Gamma_{wall} \end{cases}$$

$$u = u_{in} \quad \text{on } \Gamma_{in}$$

- **Weak form.** $V_0 = \{ v \in H^1(\Omega),\ v = 0\ \Gamma_{in} \}$

  $u \in V_t$. $\quad V_t = V \oplus u_{in}|_{\Gamma_{in}}$

$$\int_\Omega \lambda(u)\nabla u \nabla v\,dx + \int_\Omega w\nabla u\, v\,dx = \int_\Omega f v\,dx + \int_{\Gamma_{out}} c u v\,ds$$

$a(u, v) = \ell(v)$

- **Newton-Raphson algo.** Trouver $\delta u \in V_0$ tq

$$\partial_u a(u^{(k)}, v)\cdot \delta u = -(a(u^{(k)}, v) + \ell(v)) \quad \forall v \in V_0.$$

On a :

- $\partial_u a(u^{(k)}, v) \cdot \delta u = \int_\Omega \lambda'(u^{(k)}) \cdot \delta u \, \nabla u^{(k)} \nabla v \, dx$

$$+ \int_\Omega \lambda(u^{(k)}) \nabla(\delta u) \nabla v \, dx + \int_\Omega w \, \nabla(\delta u) \, v \, dx$$

$$+ \int_{\Gamma_{out}} c \, \delta u \, v \, ds$$

<u>NB.</u> CN d'existence - unicité $\lambda'(u^{(k)}) > 0$ $\forall k, \forall x$.