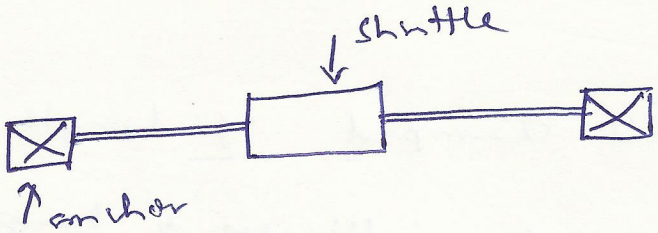
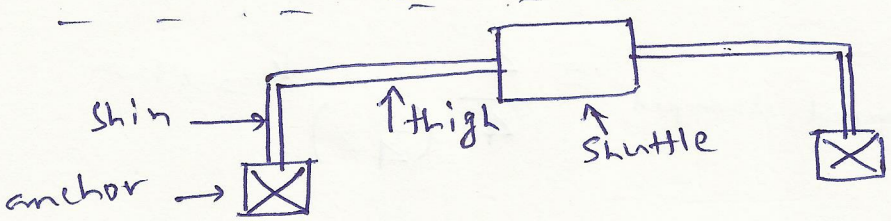
Beams are combined together to form "suspensions" with additional flexibility.

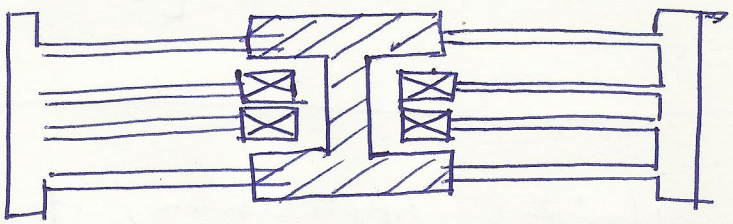
SUSPENSIONS



clamped - clamped



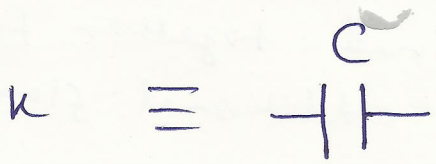
crab-leg



Folded-beam

Four characteristics of suspensions:

- Spring constant in direction of interest.
- Compliance in other directions (low)
- Tolerance towards internal stress
  (long beam buckle during fabrication)
- Linearity (during large deformations).

$k \equiv$ 

e.g. clamped-clamped of length L

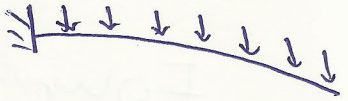
$\equiv$ 4 cantilevers of length $\left(\frac{L}{4}\right)$.

$$\therefore k_{\text{clamped-clamped}} = \frac{4}{4}\left(\frac{1}{4^3}\right) k_{\text{cantilever}}$$

$$= 64\, k_{\text{cantilever}}$$

$$= \frac{192\, YI}{L^3}.$$

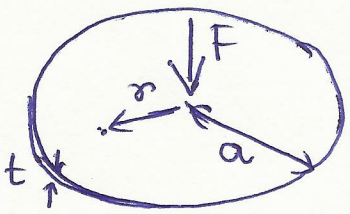
In microfluidic application, F is in the form of a uniform line pressure q (in $\frac{N}{m}$).

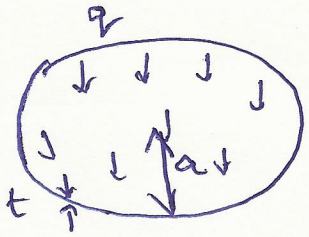


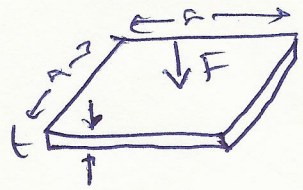
$F = qL$.

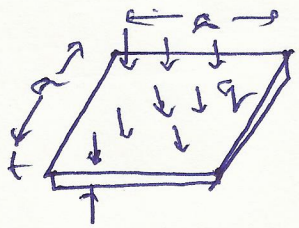
Type	Deflection	Max-dy.
Cantilever	$y = \frac{qz^2}{24YI}(z^2 - 4Lz + 6L^2)$	$\frac{qL^4}{8YI}$
Clamped-clamped	$y = \frac{qz^2}{24YI}(z^2 - 2Lz + L^2)$	$\frac{qL^4}{384YI}$

Diaphragm & Membranes









Type	Deflection	Max Def.	K
Round (force)	?	$\frac{Fa^2}{16\pi D}$	$\frac{16\pi D}{a^2}$
Round (pressure)	$y=\frac{3(1-\nu^2)q(a^2-r^2)^2}{16Et^3}$	$\frac{qa^4}{64D}$	?
Square (force)	?	$\frac{\alpha_F F a^2}{Yt^3}$	$\frac{Yt^3}{\alpha_F a^2}$
Square (pressure)	?	$\frac{\alpha_p q a^4}{Yt^3}$	?

(H.W.)

$$D=\frac{Yt^3}{12(1-\nu^2)} \quad ; \quad \alpha_F = 0.014 \quad (\text{at } \nu = 0.3).$$

$$\alpha_p = 0.061$$