Self-consistent scheme

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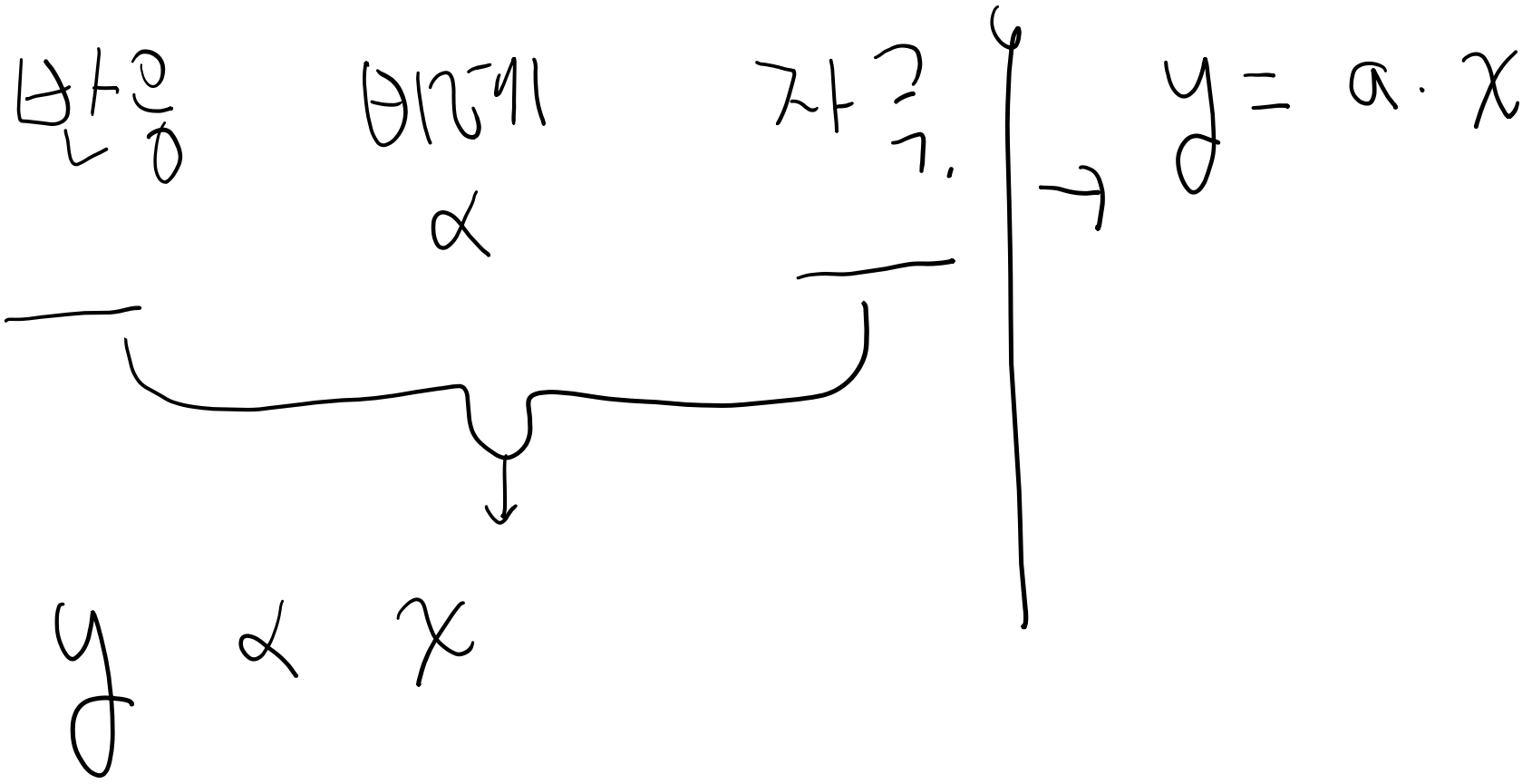
Introduction

- Self-consistent scheme itself is very general thus can be applied to both composites and metals.
- We first study the case of ‘isotropic’ aggregate, then will expand the method to ‘anisotropic’ case.

Constitutive law



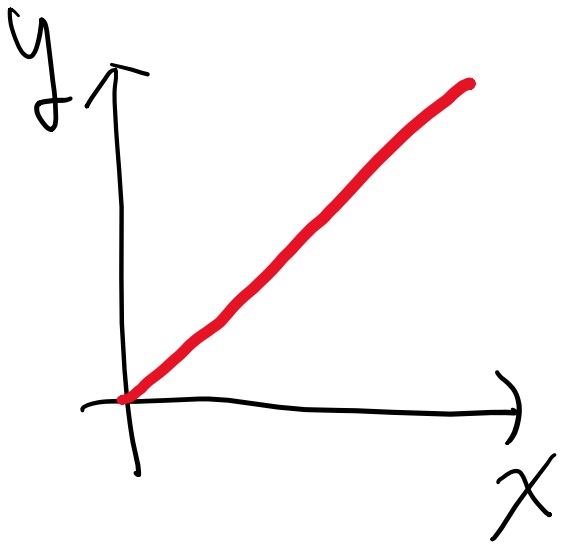
Constitutive law

$y = a \cdot x$

y → 반응

x → 자극

a → property

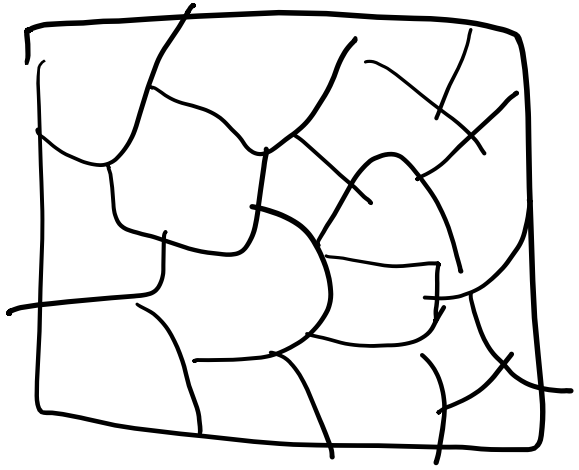


→ mathematical expression.

→ why not look at it an inverse view?

→ $x = a^{-1} \cdot y$

Material with many members.



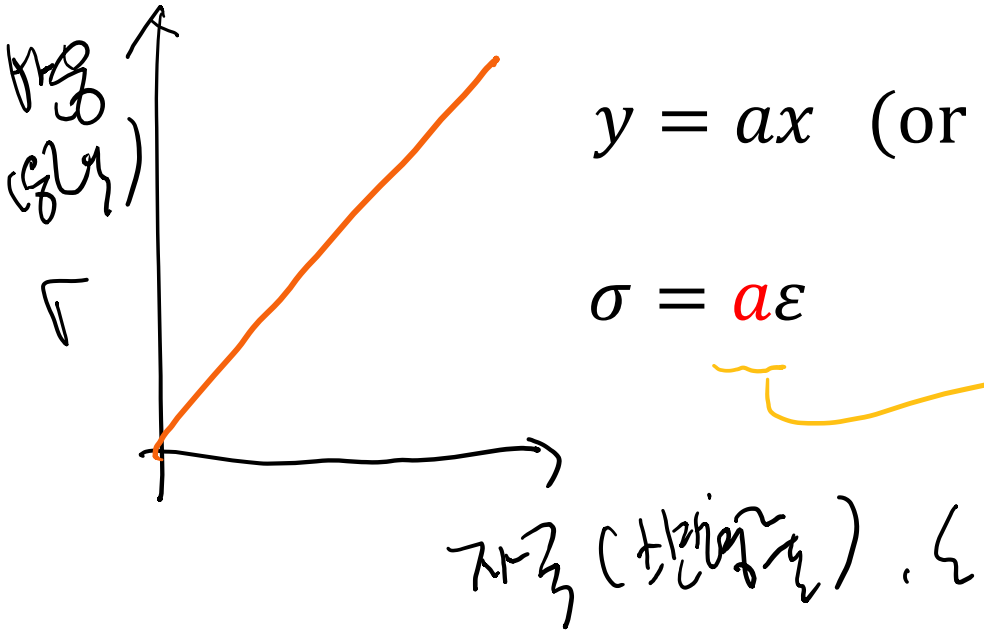
각 member의 구성방정식(자극과 반응 관계식)을 안다면

$$y = ax$$

전체 그룹(aggregate)으로써의 구성방정식(그리고 물성)을 알 수 있을까?

elastic body

실제 탄성체의 구성 방정식과 물성



$$y = ax \quad (\text{or more generally, } y = ax + b)$$

$$\sigma = a\varepsilon$$

elastic stiffness
elastic modulus.
elastic constants.
⋮

$$\varepsilon = (a)^{-1}\sigma$$

elastic compliance
⋮

실제 탄성체의 구성 방정식

$y = a \cdot x$

$\sigma = C^{el} \varepsilon^{el}$

stress　　elastic strain

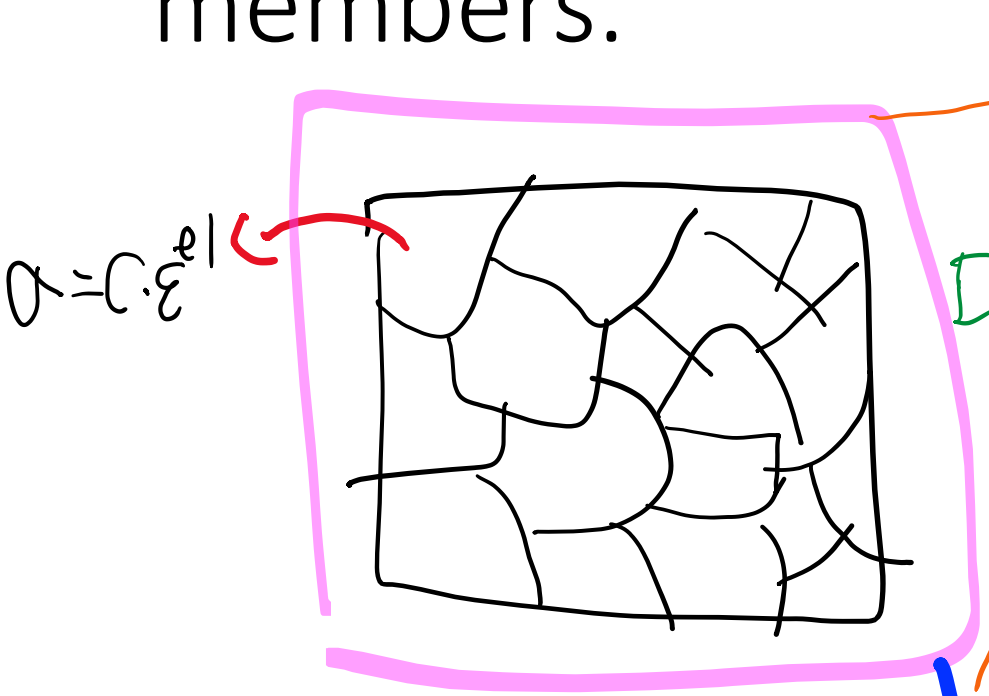
elastic moduli

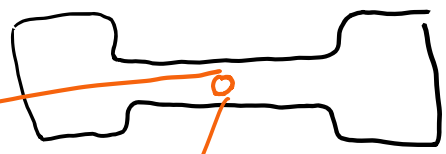
inverse?

$\varepsilon^{el} = M^{el} \sigma$

elastic compliance

Elastic material with many elastic members.





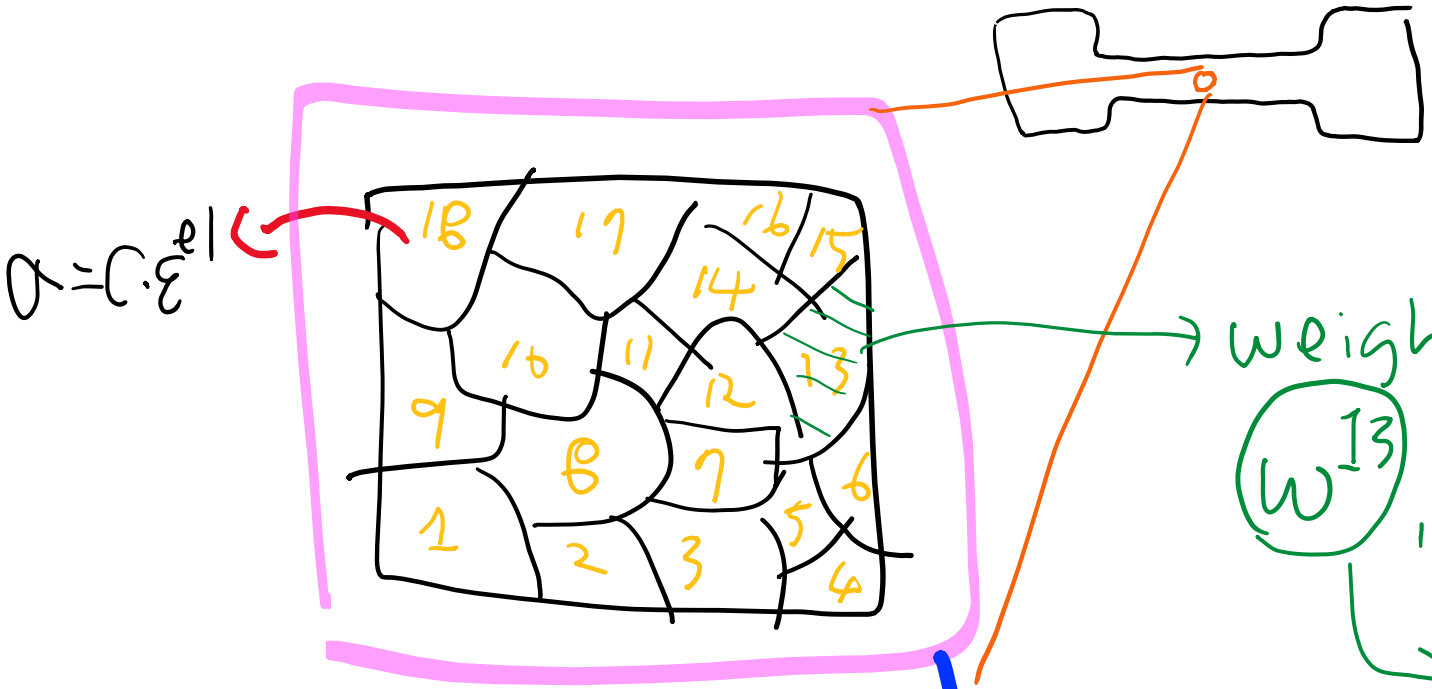
If we know each subdivided member obeys the same constitutive law.

$$y = ax$$

Can we figure out the "property" of the entire aggregate?

$\bar{\sigma}, \bar{\varepsilon}^{el}$?

The entire response/stimuli and individual response/stimuli?



$$\bar{\varepsilon}^{el} = w^1 \varepsilon^{el,1} + w^2 \varepsilon^{el,2} + \dots + \varepsilon^{el,16} \cdot w^{16}$$

$$= \sum_{i=1}^{16} \varepsilon^{el,i} \cdot w^i = \langle \varepsilon^{el} \rangle$$

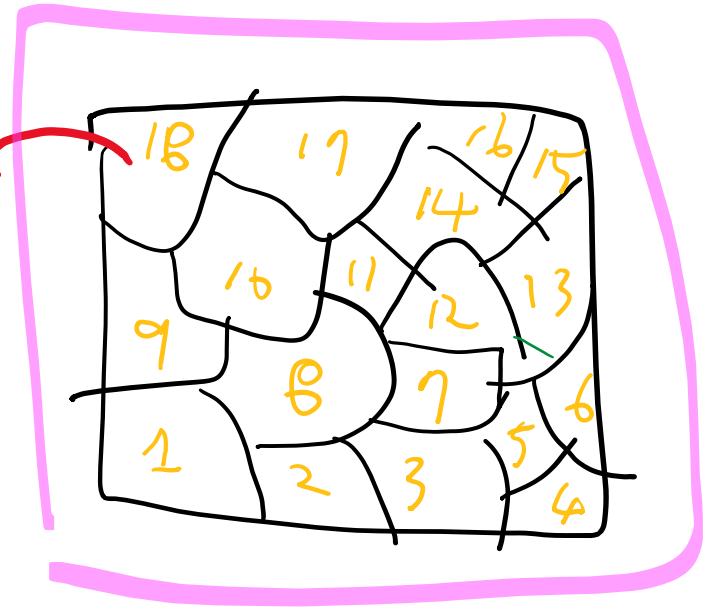
weighted average of el. strains.

$\bar{\sigma}, \bar{\varepsilon}^{el}$?

likewise ...

$\bar{\sigma} = \langle \sigma \rangle$

$\sigma = c \cdot \xi^{el}$



$\bar{\sigma} = \bar{C} \cdot \bar{\xi}^{el}$

what about this

$\bar{\sigma}, \bar{\xi}^{el}$

$\bar{C} = \langle c^{el} \rangle$?

→ We will get back to this later ...

Check.

- What is constitutive law?
- In connection with the above question, what is a material property?
- What is weighted average?
- How did we treat the elastic constitutive law?
- Can you distinguish modulus and compliance?