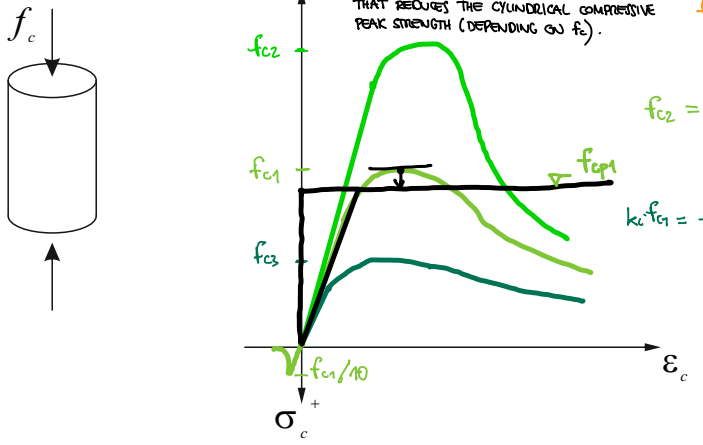
Behaviour of concrete, reinforcement, and reinforced concrete

jmf/22.09.2022

Concrete

a) Uniaxial compression:

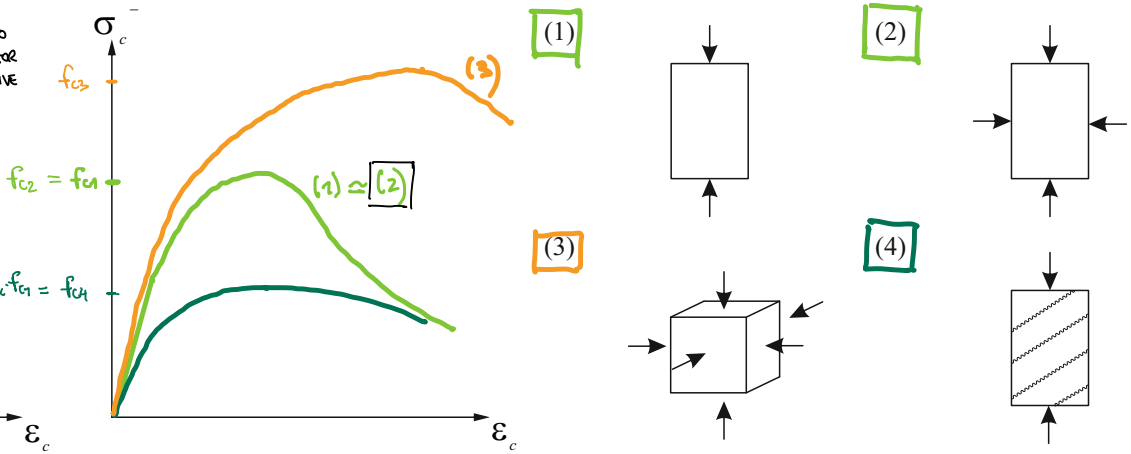
Draw the constitutive relationship of concrete for different concrete compression strengths (high, normal, low) and also the concrete behaviour assumed for design.



- CONCRETE IS MORE BRITTLE WITH INCREASING STRENGTH. THE CONCRETE STRENGTH FOR PLASTIC DESIGN NEEDS TO TAKE INTO ACCOUNT A BRITTLENESS FACTOR THAT REDUCES THE CYLINDRICAL COMPRESSIVE PEAK STRENGTH (DEPENDING ON f_c).

b) Normal strength concrete under various stress states:

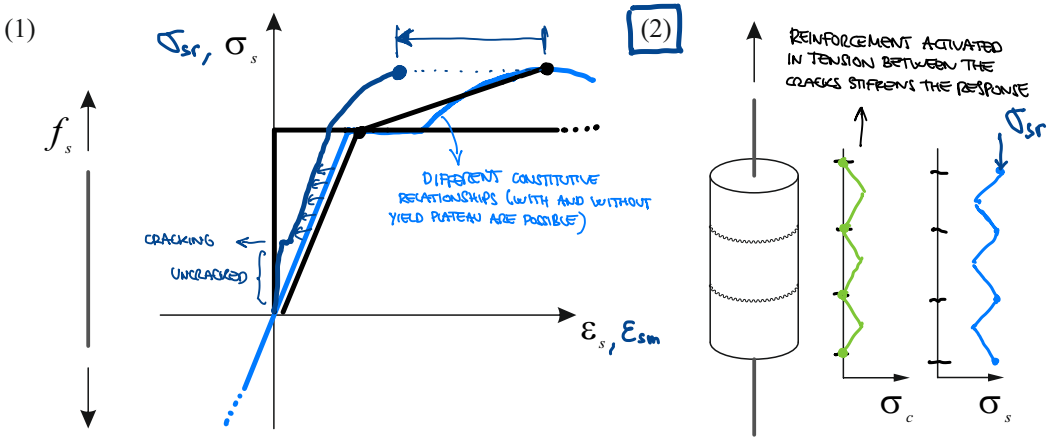
Draw the constitutive relationship of a normal concrete strength under uniaxial (1), biaxial (2), triaxial (3) stress states, and cracked state (4).



Reinforcement

c) Reinforcement:

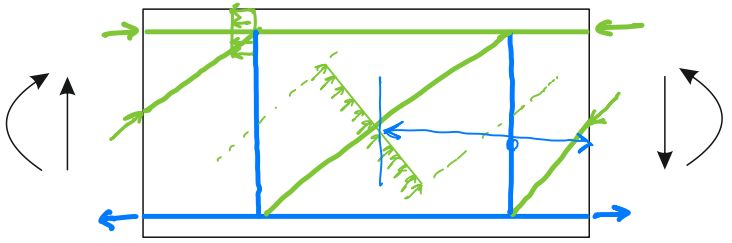
Draw the constitutive relationship in tension of a reinforcing steel bar (1) and of a tension tie, i.e. concrete plus reinforcement (2). Think about the stress transfer in the tension tie between the cracks.



- REINFORCED CONCRETE IN TENSION HAS THE SAME STRENGTH BUT IS STIFFER THAN THE REINFORCEMENT ALONE. THIS EFFECT (TENSION STIFFENING) IS BENEFITIAL FOR SERVICEABILITY VERIFICATIONS (CRACK WIDTHS, DEFLECTIONS) BUT DETRIMENTAL FOR THE DEFORMATION CAPACITY AT FAILURE

d) Strut-and-tie model and stress fields:

Think about a possible strut-and-tie model for the beam.



- CONCRETE = COMPRESSION
  REINFORCEMENT = TENSION

→ STRUT-AND-TIE MODELS → FORCE RESULTANTS
  (!) NEED TO DISTINGUISH CONCENTRATED VS DISTRIBUTED ELEMENTS
→ STRESS FIELDS