Post - Processing

There are several ways of post-processing the FE solution.

- What is post-processing?

  Extracting useful information that the analyst wants. E.g. stresses, strains, max. deflection, support loads, etc.

- Why post-process?

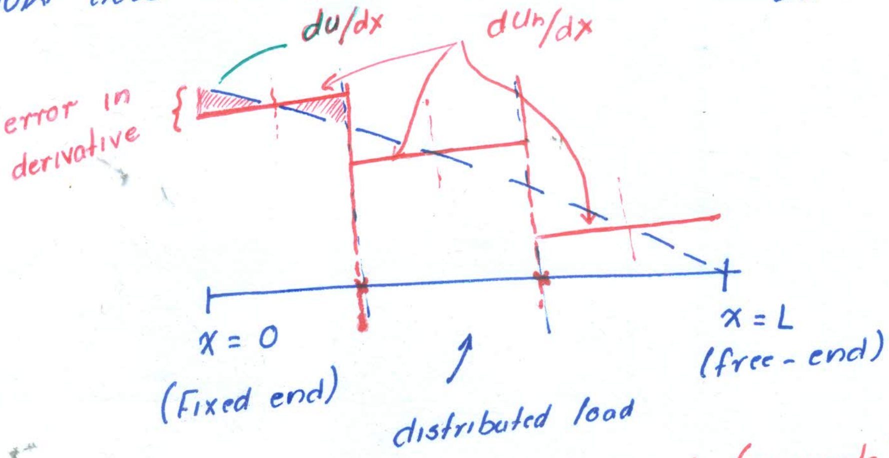
  To make design/certification decisions.

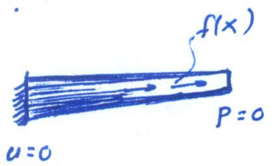
- Can we use the FE results directly?

  Yes - for displacement

  No - for strains and stresses, as these jump at inter-element boundaries and hence can portray the wrong picture!

* How does the FE-based strain (or $\frac{du_n}{dx}$) do?



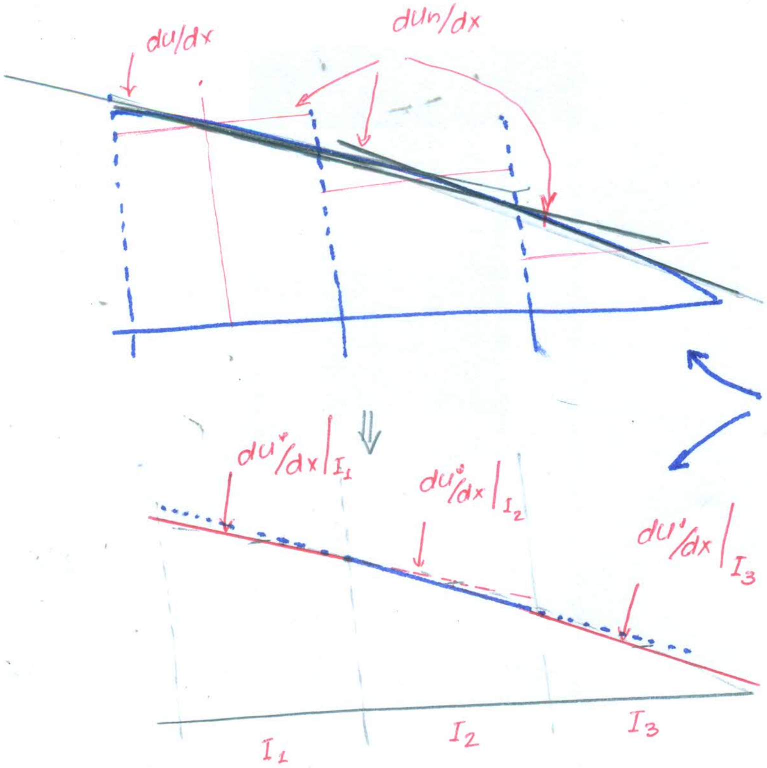


Linear approx. ($p = 1$)

3-element mesh (example)

* Constant strain in each element
  - Strains from FE solution are "good" at the centre of the element (i.e. at $\xi = 0$ in master element) ~ GAUSS INTEGRATION POINT (1-PT. RULE)!
  - strains from FE solution are "bad" at the nodes
  - FE strain at $x = 0$ (i.e. boundary node) is bad - leading to bad prediction of reaction force there.

Can we do better ?



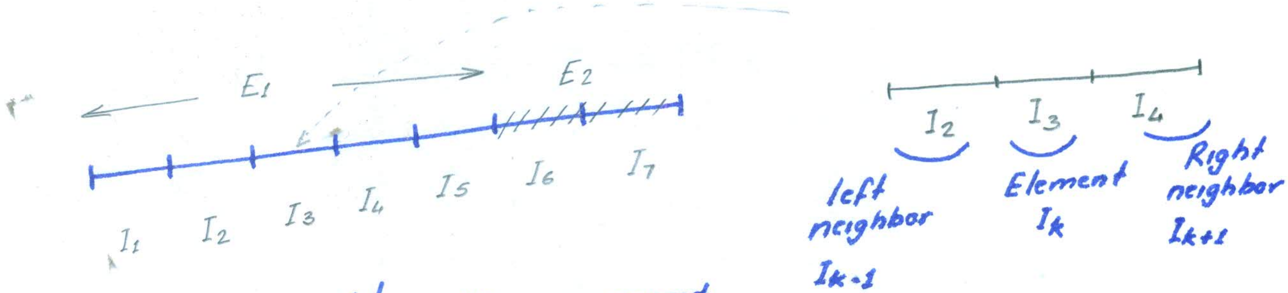
How to get better fits of $\frac{du^*}{dx}$ and/or F_{xx}^* ?

⇓

Zienkiewicz - Zhu recipe or patch - recovery scheme (Babuska, Strouboulis, CSU).

Basic Idea: Sliding averages or Least - square fit.

Let us take a generic mesh :



We want to find $F_x^*\big|_{I_k}$ <i.e. recovered axial force>

$$F_x = EA\frac{du}{dx} \Rightarrow F_x^*\Big|_{I_k} = a_0^k + a_1^k x$$ ⇐ i.e. choose it to be linear

If elements of order p, $F_x^*\big|_{I_k} = \sum_{i=0}^{p} a_i^k x^i$

where a_i^k are coefficients corresponding to the "fit" for element I_k.