Title:	On the influence of plastic zone estimates on critical damage crack growth predictions
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Abstract: (Your abstract must use Normal style and must fit in this space)	Various paths can be followed to explain and to predict the fatigue crack growth (FCG) process using solid mechanics-based theoretical tools and basic mechanical properties. Probably the most successful one correlates the fatigue crack growth **da/dN** vs. **ΔK** curve with **εN** crack initiation parameters. Following this line of thought, various analytical models based on damage accumulation by cyclic plasticity have been developed to predict the crack growth curve **da/dN** vs. **ΔK** obtained under constant amplitude loading. These critical damage models use **εN** parameters and expressions of the HRR type to represent the elastic-plastic strain range inside the plastic zone ahead of the crack tip. However, the plastic zone size is usually estimated using only the near tip solutions which do not obey the global equilibrium equations. Indeed, both the Williams and the Wetergaard singular solutions do not allow a constant stress perpendicular to the crack plane, therefore cannot reproduce the nominal stress far from the crack tip in a infinite plane under pure traction, e.g. And if this nominal stress is in the order of half the yield strength, the actual plastic zone size can be several times bigger than the one predicted by the near tip solutions, even when a Irwin type correction is included. The influence plastic zones corrected to obey the global equilibrium equations in the predicted crack growth rates is included and explored in the non-singular critical damage model which models the crack as a sharp notch with a very small but finite tip radius to remove its singularity, using a strain concentration rule such as Neuber, Glinka, or the linear rule [1-2]. In this way, the damage caused by each load cycle, including the effects of residual stresses, can be calculated at each element ahead of the crack tip using the correct hysteresis loops caused by the loading, without the need of adjustable parameters. A quite good agreement between the **εN**-based crack growth predictions and experiments is obtained for constant and variable amplitude load histories. [1]- Durán,JAR; Castro,JTP; Payão Filho,JC "Fatigue Crack Propagation Prediction by Cyclic Plasticity Damage Accumulation Models", Fatigue and Fracture of Engineering Materials and Structures, v.26(2), p.137-150, 2003 [2]- Castro,JTP; Meggiolaro,MA; Miranda,ACO "Singular and Non-Singular Approaches for Predicting Fatigue Crack Growth Behavior", International Journal of Fatigue v.27(10-12), p.1366-1388, 2005