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Abstract: Crack closure concept has been widely used to explain different issues of fatigue crack propagation. However, some authors have questioned the relevance of crack closure and have proposed alternative concepts. The main objective here is to check the effectiveness of crack closure concept by linking the contact of crack flanks with non-linear crack tip parameters.

Accordingly, 3D-FE numerical models with and without contact were developed for a wide range of loading scenarios and the crack tip parameters usually linked to fatigue crack growth, namely range of cyclic plastic strain, crack tip opening displacement, size of reversed plastic zone and total plastic dissipation per cycle were investigated. It was demonstrated that: (i) LEFM concepts are applicable to the problem under study; (ii) the crack closure phenomenon has a great influence on crack tip parameters decreasing their values; (iii) the ΔK_{eff} concept is able to explain the variations of crack tip parameters produced by the contact of crack flanks; and (iv) the analysis of remote compliance is the best numerical parameter to quantify the crack opening level. Therefore the crack closure concept seems to be valid. Additionally, the curves of crack tip parameters against stress intensity factor range obtained without contact may be seen as master curves.