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Abstract: The solution of an infinite plane containing an arbitrarily located micro-crack and a kinked macro-crack is presented based on the distributed dislocation technique (DDT). The stress field, the plastic zone of the macro-crack tip (PZ) and the stress intensity factors at the macro-crack tip (SIFs) are obtained. The influence of the micro-crack on the kinked macro-crack is investigated. The results show the effect of the micro-crack on SIFs increases with the micro-crack length increasing, the distance *d* decreasing and the micro-crack angle decreasing. The micro-crack has an amplifying effect on mode I SIF at about $-80° < \theta < 60°$, while it has a shielding effect at about $-90° < \theta < -80°$ and $60° < \theta < 90°$. The micro-crack has an amplifying effect on mode II SIF at about $-90° < \theta < 20°$, while it has a shielding effect at about $20° < \theta < 90°$. The micro-crack ahead of PZ has a little amplifying effect on PZ. As the micro-crack is close to the macro-crack tip, plastic zones of the micro-crack tip and macro-crack tip will join together. PZ is split into two pieces by the micro-crack located in PZ. The micro-crack behind PZ has no effect on PZ. These results are helpful to analyze the fracture or fatigue behaviors of materials.

Keyword: micro-crack; kinked macro-crack; stress intensity factor; plastic zone

1. Introduction

Fracture is a very dangerous failure mode. Fracture mechanics has been an important research field since last century. For the materials containing cracks, the crack tips are the most dangerous regions. The primary interest of fracture mechanics is focused on the crack tip. For small-scale yield, SIFs are presented to represent the stress concentration at the crack tip. As the applied load increases, the yield zone will increase. In this case, the PZ is applied to analyze the behaviors of the crack tip.

Under the influence of external loads or material internal defects, the crack propagation deviates from its original direction and a kinked crack is formed. The