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Numerical and Experimental Study of the Plastic Zone in the Vicinity of the Crack Tip by the Optical Caustics Method

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In industrial applications, knowing the morphology of the plastic region allows the prevention of crack propagation that may lead to serious crack extensions. In the case of fragile materials, the development of the plastic zone is ignored, but the same hypothesis does not apply to ductile materials. For these materials, when dealing with a stationary problem, we notice an important development of the plastic zone in the proximity of the crack tip, before reaching the rupture stress limit and before the crack begins to extend. We have to add that the plastic region keeps developping alongside with the crack extension. In this paper we aim at demonstrating by numerical simulations, followed by experimental tests that for a ductile specimen SEN loaded in the mode I, the topological changes of the crack tip, due to plasticity, can be revealed by the optical caustics phenomenon.

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