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Review of “Crack branching at low tip speeds: spilling the T”

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^E Editor

Review of version 1

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Authors We have appreciated the reviewers' support for our publication and their comments. Their response letter allowed us a convenient opportunity to revise some statements that were more ambiguous than intended and to enhance the presentation of some figures' captions.

Remark: As we recognize the importance of reproducibility of the published results in scientific experiments, we added in the paper Table 3 to further shed light on the different parameters regarding the acquisition of the images and the DIC analysis.

Reviewer 1 (Anonymous)

Reviewer The fact that Eq. (7) does not involve the radius from the crack tip as a variable is misleading, as the proposed criterion is actually based on a critical radius. An expression of the stress as a function of v_c , θ and r (instead of the coordinates x_1 and x_2) would help the reader to better follow the next parts.

Authors We thank the reviewer for their displayed interest in our research and their support of our publication but also for their constructive comments. As requested by the reviewer, Equations (2, 3, 4, 5, 6, 7) have been rewritten to better involve the radius r from the crack-tip as a variable as well as the angle θ and the crack-tip speed v_c . This allows the following developments to be much easier to follow.

Reviewer A discussion about the broadening of the phase field crack in dynamic phase fields simulations has been presented in <https://hal.science/hal-01390233>. This article should be cited, and the discussions related with the comments made in this work.

Authors We made good use of the article the reviewer has mentioned (Bleyer and Molinari, 2017), and added a remark (Remark 6) regarding the widening of the damage-band in 2D phase-field simulations, and how this widening is linked to micro-branching processes (three dimensional instabilities) prior to macrobranching. As per (Bleyer and Molinari, 2017), that could be the signature of the roughening of the crack surfaces observed experimentally.

Reviewer In Fig. 7b, it is not clear what means the “notch”. Fig. 7a suggests that this region is already an initial crack.

Authors As suggested by the reviewer, the “notch”, by which we meant the initial crack (geometrically defined) has been renamed to ‘tip of the initial crack’ in Figure 7. We understand that this modification should suppress any ambiguity related to the modelling and naming of this region

in the sample.

Reviewer Still in Fig. 7b, a widening of the phase field crack is observed in the region of the initial crack. Then, what is the meaning of discussing its relation with some instability, as physically this crack is already existing and has no finite thickness?

Authors We believe that what the reviewer meant by "widening of the phase-field crack" in the region of the initial crack that appears wider than the propagating crack. This is not a fruit of a widening phenomenon as the crack advances but is actually an initially wider damage-band around the initial crack. In fact, we model the initial crack both geometrically (with a non-zero thickness of the crack) and through a Dirichlet boundary condition for the phase-field problem (damage value = 1, imposed as an initial boundary condition) on the surface of the initial crack. And that is the reason why in Figure 7b, the damage-band around the initial crack surfaces appears thicker than the propagating crack. The method of modelling the initial crack has been tackled in Section 4.1 and in the caption of Figure 7 to suppress any ambiguity related to the width of the damage-band in the initial crack.

Reviewer Page 4, section 1: there is no section 1.2. Consider removing the title of subsection 1.1.

Authors The numbering of the subsection have been removed from Section 1.1 as suggested by the reviewer.

Reviewer 2 (Anna PANDOLFI)

Reviewer Abstract, last sentence: there is no verb. Please check.

Authors The last sentence of the abstract has been reformulated to: "This permits the experimental validation of the developed crack (in)stability criterion."

Reviewer Page 9 after section 4.1. title. The first sentence "It's a pre-notched..." is awkward.

Authors The first sentence of the Section 4.1 has been re-written as: "Borden et al. (2012) propose to model a pre-notched rectangular plate loaded dynamically in tension."

Reviewer It seems that the caption of Figure 7 is missing.

Authors Indeed, a problem which made the caption of Figure 7 seems missing occurred. We tuned the captions of the Figure 7 -and its subfigures- to better clarify some points (as mentioned in the 4th comment of the previous reviewer)

Editor's assessment (Anna PANDOLFI)

In this paper the authors describe an innovative criterion for dynamic crack instability using a combination of experimental, theoretical and numerical tools that prove the validity of the approach. The review of the paper took quite a long time, since many invited reviewers declined, and we had troubles with the system to make the manuscript available to the reviewer and the review to the authors. The only reviewer that accepted the work did an excellent job that helped in removing the very few flows of the original submission. As editor in charge, I was in agreement with the reviewer and with the revised version of the paper.

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