Dyamic crack propagation : numerical estimation of inertial effect

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ABSTRACT

The dynamic crack propagation regime can be defined by the moment when the front crack reaches a critical state and a self-sustained propagation regime is inititated and goes on as long as internal energy is stocked in the structure.

To study this propagation regime, the critical energy release rate in dynamic must be evaluated regarding the crack velocity. Experimentally, it is then very important to limit, or at least to quantify, the inertial effects during the propagation in order to build the G-curve. Some specific dynamic fracture tests are well known to produce low inertia effects such as the Strip Bond Specimen (SBS) test. Nevertheless, due to the manufacturingn process or the technological environnement, samples can be limited to specific shapes or specific standard fracture tests.

It is then necessary to quantify the kinetic energy during a rapid crack propagation and evaluate a dynamic correction factor related to a specific geometry and boundary condition set up.

In this work, a numerical methodology is proposed to evaluate velocity field in the whole sample during a crack propagation at different velocity, related to the Rayleigh wave speed. The use of the node release technic will be first described with a rigorous validation by comparing results with the analytical Broberg solution.

SBS test, Brazilian test, Disck Compact Tension test and other classical fracture tests will be then analyzed with this crack propagation simulation.

Finally, a dynamic correction factor will be given and a conclusion wil be made on all the analyzed tests.

REFERENCES

[1] Kopp, Jean-Benoit and Lin, Jian and Schmittbuhl, Jean and Fond, Christophe, Longitudinal dynamic fracture of polymer pipes. *European Journal of Environmental and Civil Engineering* (2014) **18**:1097–1105.

[2] A. Core, J.-B. Kopp, J. Girardot, P. Viot, Study of the dynamic fracture of hollow spheres under compression using Discrete Element Method. *Procedia structural Integrity* (2018) **13**:1378–1383.

[3] A. Core, J.-B. Kopp, J. Girardot, P. Viot, Dynamic energy release rate evaluation of rapid crack propagation in discrete element analysis. *International Journal of Fracture* (2018) **214**:17–28.