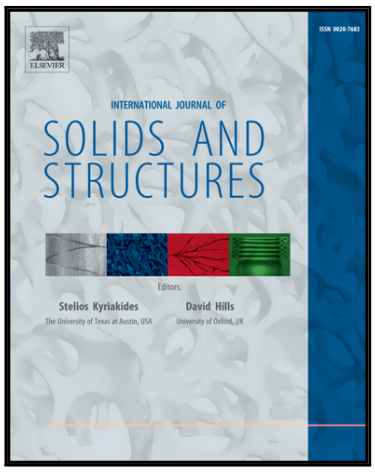

Uncertainty quantification and global sensitivity analysis of longitudinal wave propagation in circular bars. Application to SHPB device

D. Brizard, E. Jacquelin

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Uncertainty quantification and global sensitivity analysis of longitudinal wave propagation in circular bars. Application to SHPB device.

D. Brizard[1,*], E. Jacquelin[1]

[a] *Univ Lyon, Université Claude Bernard Lyon 1, IFSTTAR, LBMC UMR_T9406, F69622, Lyon, France*

Abstract

The experimental characterisation of materials at intermediate strain rates often implies the use of split Hopkinson pressure bars. Shifting the measured pulses in the bars requires to take dispersion into account. However, the dispersion correction, in the case of linear elastic bars, relies on physical parameters which are measured with a given accuracy (bar velocity c_0, bar radius r_0, Poisson's ratio ν and propagation distance x). The object of the present article is to evaluate the influence of the uncertainty on these parameters and quantify the uncertainty on the resulting propagated pulse.

A common dispersion correction method is based on a nonlinear curve fitting approach of the real dispersion curve. The accuracy of this approximate method is first assessed and we show that it can lead to non negligible errors on the computation of the propagated pulse in the context of SHPB (typically a few percent). The numerical solving of the dispersion equation is therefore preferred. We then use Latin hypercube sampling to perform an uncertainty quantification (UQ) on the propagated pulse. The next step is a Sobol' sensitivity analysis (SA) to identify the most influential parameters

*Corresponding author

Email addresses: denis.brizard@ifsttar.fr (D. Brizard), eric.jacquelin@univ-lyon1.fr (E. Jacquelin)