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A Novel integrated experimental-numerical method for characterisation of materials at high strain rates. BEN ELLIOTT, ARIN JUMPASUT, NIK PETRINIC, CLIVE SIVIOUR, University of Oxford — Accurate prediction of material response at high strain rates necessarily requires an integrated approach to developing, calibrating and validating constitutive models. Experimental characterisation is a challenging task and simplified analyses inherently contain a number of unrealistic assumptions. These lead to results that are insufficiently accurate for use in challenging industrial design such as that found in aerospace applications. These problems can be avoided by the use of an integrated experimental-numerical approach which explicitly models non-ideal aspects of the characterisation procedures. This paper will demonstrate such an approach, where the problem is addressed by solving a related inverse problem. Calibration experiments and instrumentation thereon must be carefully chosen to provide appropriate information for a suitable numerical model of the material. In this case, Hopkinson bar experiments at various temperatures were used in conjunction with high speed photography and image processing to provide accurate experimental data. These were used directly within numerical models of the experiments in order to form a problem that could be accurately solved using inverse methods to yield useful physical material information. The properties obtained and material models chosen were validated using an experiment sufficiently complex to be industrially meaningful.

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