

**Williams, Brian; Higdon, Dave; Gattiker, Jim; Moore, Leslie; McKay, Michael; Keller-McNulty, Sallie**

**Combining experimental data and computer simulations, with an application to flyer plate experiments.** (English) [Zbl 1331.62508](#)

*Bayesian Anal.* 1, No. 4, 765-792 (2006).

Summary: A flyer plate experiment involves forcing a plane shock wave through stationary test samples of material and measuring the free surface velocity of the target as a function of time. These experiments are conducted to learn about the behavior of materials subjected to high strain rate environments. Computer simulations of flyer plate experiments are conducted with a two-dimensional hydrodynamic code developed under the Advanced Strategic Computing (ASC) program at Los Alamos National Laboratory. This code incorporates physical models that contain parameters having uncertain values. The objectives of the analyses presented in this paper are to assess the sensitivity of free surface velocity to variations in the uncertain inputs, to constrain the values of these inputs to be consistent with experiment, and to predict free surface velocity based on the constrained inputs. We implement a Bayesian approach that combines detailed physics simulations with experimental data for the desired statistical inference. The approach given here allows for: uncertainty regarding model inputs (i.e. calibration); accounting for uncertainty due to limitations on the number of simulations that can be carried out; discrepancy between the simulation code and the actual physical system; and uncertainty in the observation process that yields the actual field data on the true physical system. The resulting analysis accomplishes the objectives within a unified framework.

**MSC:**

- [62P35](#) Applications of statistics to physics
- [62-07](#) Data analysis (statistics) (MSC2010)
- [76-05](#) Experimental work for problems pertaining to fluid mechanics
- [76L05](#) Shock waves and blast waves in fluid mechanics
- [76M25](#) Other numerical methods (fluid mechanics) (MSC2010)

Cited in **6** Documents

**Keywords:**

calibration; computer experiments; flyer plate experiments; Gaussian process; model validation; predictability; predictive science; sensitivity analysis; uncertainty quantification

**Full Text:** [DOI](#) [Euclid](#)