© 2013 FIZ Karlsruhe

io-port 06113660

Challenor, Peter

Using emulators to estimate uncertainty in complex models.

Dienstfrey, Andrew M. (ed.) et al., Uncertainty quantification in scientific computing. 10th IFIP WG 2.5 working conference, WoCoUQ 2011, Boulder, CO, USA, August 1–4, 2011. Revised selected papers. Berlin: Springer (ISBN 978-3-642-32676-9/hbk; 978-3-642-32677-6/ebook). IFIP Advances in Information and Communication Technology 377, 151-164 (2012).

Summary: The managing uncertainty in complex model projects has been developing methods for estimating uncertainty in complex models using emulators. Emulators are statistical descriptions of our beliefs about the models (or simulators). They can also be thought of as interpolators of simulator outputs between previous runs. Because they are quick to run, emulators can be used to carry out calculations that would otherwise require large numbers of simulator runs, for example Monte Carlo uncertainty calculations. Both Gaussian and Bayes linear emulators are explained and examples are given. One of the outputs of the MUCM project is the MUCM toolkit, an on-line recipe book for emulator based methods. Using the toolkit as our basis we illustrate the breadth of applications that can be addressed by emulator methodology and detail some of the methodology. We cover sensitivity and uncertainty analysis and describe in less detail other aspects such as how emulators can also be used to calibrate complex computer simulators and how they can be modified for use with stochastic simulators.

Keywords: sensitivity; calibration; numerical examples; Gaussian linear emulator; Monte Carlo uncertainty calculations; Bayes linear emulators; stochastic simulators
doi:10.1007/978-3-642-32677-6_10