The Use of High Dimensional Model Representations for the Analysis of Complex Modelling Systems.

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The evaluation and reduction of complex models involves the analysis of the relative importance of often very large numbers of parameters or variables. Sensitivity analysis is often employed for this purpose and several methods for its application in parameter importance and model reduction studies have been developed in recent years. Local linear methods are most commonly used since they are usually computationally quite efficient. However, for highly nonlinear models , local methods can sometimes lead to erroneous results, particularly where the values of the model input parameters are quite uncertain. In some cases, local sensitivity coefficients can often be quite different for parameter values which are sufficiently far from the nominal ones. Importance analysis or model reduction based on the often uncertain nominal values therefore becomes problematic. For example, in chemical kinetic models this could be a common occurrence since many of the thermochemical parameters have to be estimated in cases where *ab initio* modelling or detailed experimental studies have not yet been carried out. It is therefore important to develop global sensitivity methods which can provide reliable sensitivity indices over wide ranges of model inputs. The paper will present the high dimensional model representation method for the global sensitivity analysis of complex models. A Matlab based software package, which has been developed for general application to any complex model and which is freely available, will be demonstrated. Examples of its application will be provided from the fields of combustion and air pollution modelling in order to illustrate the power of the approach, and to highlight potential differences compared to the use of local sensitivity coefficients.