Sensitivity Analysis of Aerospace Manufacturing Variations via Polynomial-based Compressive Sensing

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Polynomial-based methods for uncertainty quantification are typically used within a model for propagating uncertainties using either non-intrusive or intrusive methods. In the former, a model is simply run with specific inputs within the parameter space, while in the latter, the governing equations of the model are varied.

In this poster, we study a data-driven approach; the data is the measured (x,y,z) coordinate of fan blades on different aero-engines. Each engine has been experimentally rig tested and has an associated fan system efficiency value.

A polynomial approximation is constructed via compressed sensing techniques to fit this sparse data —i.e., far more blade measurements than efficiency values—to a global response surface. Following this, variance- and skewness-based sensitivity indices are used to infer which manufacturing deviations are detrimental to efficiency and which are beneficial.