



# **Uncertainty Quantification in Computational Fluid Dynamics and Aircraft Engines (SpringerBriefs in Applied Sciences and Technology)**

*Francesco Montomoli, Mauro Carnevale, Antonio D'Ammaro, Michela Massini, Simone Salvadori*

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This book introduces novel design techniques developed to increase the safety of aircraft engines. The authors demonstrate how the application of uncertainty methods can overcome problems in the accurate prediction of engine lift, caused by manufacturing error. This in turn ameliorates the difficulty of achieving required safety margins imposed by limits in current design and manufacturing methods.

This text shows that even state-of-the-art computational fluid dynamics (CFD) are not able to predict the same performance measured in experiments; CFD methods assume idealised geometries but ideal geometries do not exist, cannot be manufactured and their performance differs from real-world ones. By applying geometrical variations of a few microns, the agreement with experiments improves dramatically, but unfortunately the manufacturing errors in engines or in experiments are unknown. In order to overcome this limitation, uncertainty quantification considers the probability density functions of manufacturing errors. It is then possible to predict the overall variation of the jet engine performance using stochastic techniques.

*Uncertainty Quantification in Computational Fluid Dynamics and Aircraft Engines* demonstrates that some geometries are not affected by manufacturing errors, meaning that it is possible to design safer engines. Instead of trying to improve the manufacturing accuracy, uncertainty quantification when applied to CFD is able to indicate an improved design direction. This book will be of interest to gas turbine manufacturers and designers as well as CFD practitioners, specialists and researchers. Graduate and final year undergraduate students may also find it of use.

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