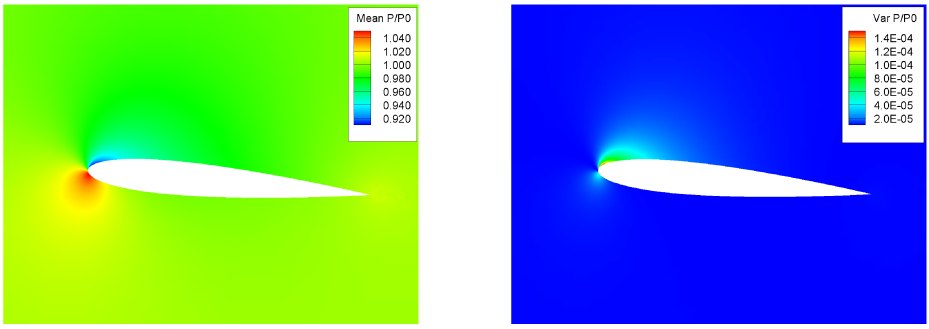
Another way to visualize the resulting stochastic solution is by observing the mean and variance of the pressure field around the airfoil. Figure 5. shows the pressure fields obtained from a 4^{th} order Probabilistic Collocation computation. The mean pressure around the airfoil is shown in Figure 5.(a) and the variance of the pressure field in (b). From the variance field it is clear that the input uncertainty results in a higher uncertainty near the leading edge of the airfoil's upper surface.



(a) (b)

Figure 5. The mean(a) and the variance(b) pressure field obtained from a 4^{th} order Probabilistic Collocation computation, with Fine$^{\text{TM}}$/Hexa as deterministic solver.

If one is interested in the pressure distribution or skin friction on the airfoil surface, the uncertainty can be represented by uncertainty bar plots. Figure 6. shows the pressure distribution on the upper and lower surface with the uncertainty bars indicating the interval which contains 99% of all possible values. This interval is obtained from the distribution function of the pressure at each position on the airfoil. It can be seen in the figure that the uncertain free stream Mach number leads to the highest variation in pressure on the upper surface near the leading edge. The uncertainty bars for the skin friction along the airfoil surface are shown in Figure 7. The skin friction shows large variations along the entire airfoil for an uncertain free stream Mach number.

5. The two step approach

Since the propagation of probability distributions for multiple uncertain parameters is computationally intensive a two step approach is followed. The first step consists of a Sensitivity Analysis, which is performed to identify the most important parameter of the problem. After that in the second step the uncertainty of the identified parameter is propagated using the Probabilistic Collocation method which results in the stochastic response of the solution based on