

Fig. 3 is the optimized airfoil, Fig. 4 is the pressure distribution of the optimized airfoil. The optimized design variables, m , p are 0.0401, 0.3991 respectively.

The optimized airfoil can satisfy the take-off and landing, and the pressure distribution on the upper and lower airfoil surfaces is reasonable. Moreover, from the point of view of manufacturing technology, there does not exist concave on the airfoil.

XFOIL [13] is one application software for airfoil analysis and reverse design written by Harold Youngren, Aerocraft, Inc., MIT Aero & Astro based on the panel methods. In the condition of 60 km/h velocity, XFOIL analysis results for NACA2415 and the optimized airfoil are shown in table I, we can see that lifting coefficients are added from 0 to 12 degree of angle of attack with respect to the drag coefficients.

TABLE I. RESULTS COMPARISON FOR NACA2415 AND THE OPTIMIZED AIRFOIL BY XFOIL

$\alpha(^{\circ})$	NACA2415			Optimized airfoil			$\Delta C_l\%$	$\Delta C_d\%$
	C_l	C_d	C_m	C_l	C_d	C_m		
0	0.233	0.0082	-0.049	0.429	0.0089	-0.088	84.1	8.53
2	0.456	0.0089	-0.046	0.811	0.0101	-0.119	77.9	13.5
4	0.763	0.0102	-0.064	0.942	0.0111	-0.101	23.5	8.82
6	0.921	0.0116	-0.051	1.083	0.0124	-0.084	17.6	6.90
8	1.072	0.0143	-0.038	1.191	0.0139	-0.062	11.1	-2.80
10	1.189	0.0189	-0.022	1.277	0.0177	-0.040	7.40	-6.35
12	1.281	0.0259	-0.008	1.328	0.0259	-0.021	3.67	0.00

VI. CONCLUSIONS

First of all, this paper analyzed the representations of airfoil and its optimization methods, and put forward the airfoil optimization variables m , p , and established the objective function and constraints.

Then, according to the theory and method of the Vortex panel and Source panel, calculation method of the airfoil aerodynamic coefficients was established.

Furthermore, according to optimization function and aerodynamic coefficient calculation method, the airfoil has been optimized, the optimized airfoil not only meet the take-off and landing requirements, but also is suitable for manufacturing.

Finally, the aerodynamic coefficient comparison between NACA2415 airfoil and the optimized airfoil showed that the optimized airfoil aerodynamic performance is improved.

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