SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution)

Department of Aerospace Engineering

23AST101-Fundamentals of Aerospace Engineering

UNIT-2:
AERODYNAMICS

NACA AIRFOILS

Mr.N.Venkatesh (AP/Aerospace)

NACA airfoils are a series of airfoil shapes developed by the National Advisory Committee for Aeronautics (NACA), the predecessor to NASA. These airfoils are widely used in aircraft design due to their well-documented and predictable performance characteristics. The NACA airfoils are defined by a series of digits that describe their geometric properties.

Types of NACA Airfoils

4-Digit Series:

Example: NACA 2412

Description:

The first digit (2) represents the maximum camber as a percentage of the chord.

The second digit (4) indicates the position of the maximum camber from the leading edge in tenths of the chord.

The last two digits (12) represent the maximum thickness of the airfoil as a percentage of the chord.

NACA 2412

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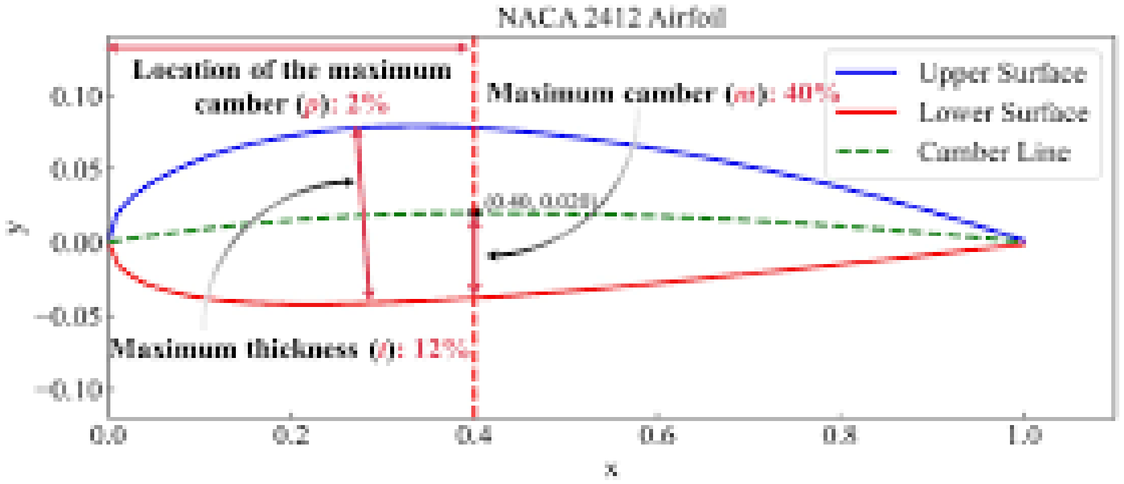


5-Digit Series:

Example: NACA 23012

Description:

The first digit (2) indicates the design lift coefficient in tenths.

The second and third digits (30) describe the position of the maximum camber in hundredths of the chord.

The last two digits (12) represent the maximum thickness as a percentage of the chord.

6-Series (Laminar Flow Airfoils):

1. **Example**: NACA 641212

Description:

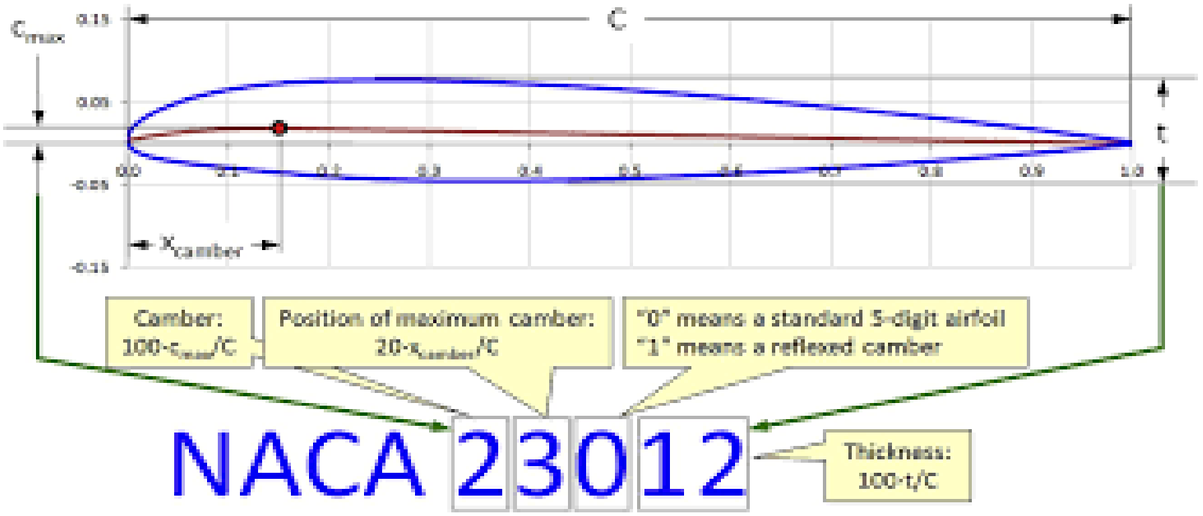
6 → 6-series airfoil

4 → Minimum pressure at 40% of the chord

1 → Designed for a lift coefficient of 0.1

2 → Camber type

12 → Maximum thickness is 12% of the chord



7-Series:

1. **Example**: NACA 747A315
2. **Description**:

1.The first digit (7) indicates the series.

2.The second digit (4) represents the position of minimum pressure in tenths of the chord.

3.The third digit (7) indicates the range of lift coefficients for low drag.

4.The letter (A) denotes the specific design within the series.

5.The last three digits (315) represent the maximum thickness as a percentage of the chord.

Applications

NACA airfoils are used in a variety of applications, including:

- **Aircraft Wings**: Different airfoils are selected based on the desired performance characteristics such as lift, drag, and stall behavior.
- **Propellers and Rotors**: Airfoils are chosen to optimize efficiency and thrust.
- **Wind Turbines**: Airfoils are designed to maximize energy extraction from wind.
- **Automotive**: Used in the design of car bodies and spoilers to manage airflow and reduce drag.

Advantages

- **Predictability**: The performance characteristics are well-documented and predictable.
- **Versatility**: A wide range of airfoils is available for different applications.
- **Optimization**: Airfoils can be optimized for specific performance criteria such as lift-to-drag ratio, stall characteristics, and thickness.

Disadvantages

- **Complexity**: Some of the more advanced series (like the 6 and 7 series) can be complex to design and manufacture.
- **Specialization**: Airfoils are often optimized for specific conditions, which may limit their performance in off-design conditions.


THANK YOU!