# Simulation Scope

The Base System covers a wide scope of fluid flow and heat transfer scenarios to perform reliable 3D simulations of high speed turbulent and incompressible flows, along with conduction and convective heat transfer. The scope of simulation capabilities is easily expanded through the addition of the Advanced and Motion modules.

## Fluid Flow

***Fluid flow is the study of liquids and*** *gases moving in and around physical objects.*

*The number of applications is limitless, but understanding the role of flow is essential for good mechanical design. Some examples of fluid flow include the aerodynamics/lift/drag of an airplane wing, the pressure drop of water passing through a valve, and the distribution of exhaust gas through the runners of an automotive exhaust manifold.*

***The following list summarizes the fluid flow capabilities of the CFdesign Base configuration:***

- Laminar
- Turbulent
- Incompressible
- Subsonic and Transonic
- Steady state
- 2D and 3D Cartesian
- 2D axisymmetric
- Velocity and Pressure boundary conditions
- Volume flow rate and Mass flow rate boundary conditions
- External fan curve with rotational speed and slip factor
- Slip/Symmetry and Unknown (natural)
- Spatially-periodic boundary conditions
- Velocity and Pressure initial conditions

## Heat Transfer

***Heat Transfer is the study of the movement of energy due to temperature variation.***

*The study of heat transfer is essential for ensuring product performance and life-cycle durability in many industries. Typical applications for CFD include predicting the temperature of electronic components in a telecommunications module, ensuring that the occupants of a crowded meeting hall are thermally comfortable, and assessing the uniformity of a temperature distribution in a manufacturing process.*

***The following list summarizes the heat transfer capabilities of the CFdesign Base configuration:***

- Conduction
- Convection (with automatic film coefficient calculation)
- Forced convection (with automatic transition from flow to thermal)
- Natural convection (buoyancy-driven with gravity vector)
- Thermal Comfort calculation
- Conjugate heat transfer (simultaneous conduction and convection)
- Quick modes: Forced Convection and Natural Convection
- Temperature, film coefficient, and radiation boundary conditions
- Area-based and Total heat flux boundary conditions
- Volume-based and Total heat source boundary conditions
- Temperature-dependent heat source boundary conditions with user-defined sensing location
- Temperature initial conditions

## Turbulence

***Turbulence is a flow regime characterized by chaotic fluctuations. Most engineering flows are turbulent, and CFdesign includes a diverse set of turbulence models that cover a wide range of applications:***

- K-epsilon
- Low Reynolds number K-epsilon
- RNG
- Constant eddy-viscosity
- Mixing Length
- Automatic turbulence startup (for seamless integration of turbulence into the solution)
- Laminar