The uses of bernoullis principle engineering essay

Airplanes experience a “ lift” force on their wings, keeping them up in the air, if they are moving at a sufficient high speed relative to the air and the wing is tilted upward at a small angle, the angle of attack. The upward tilt, as well as the rounded upper surface of the wing, causes the streamlines to be forced upward and to be crowded together above the wing. The area of air flow between any two streamlines is reduced as the streamlines are squished together. Because the air speed is greater above the wing than below it, the pressure above the wing is less than the pressure below the wing, which is Bernoulli’s principle. Hence, there is a net upward force on the wing called dynamic lift. Experiments show that the speed of air above the wing can even be double the speed of the air below it. Friction between the air and wings exerts a drag force, toward the rear, which must be over come by the planes engines. A flat wing, or the one with symmetric cross section, will experience lift as long as the fron of the wing is tilted even if the attack angle is zero, because the rounded upper surface deflects air up, squeezing the streamlines together. Airplanes

Baseball Curve

Why a spinning pitched baseball (or tennis ball) curves can also be explained using Bernoulli’s principle. It is simplest if we put ourselves in the reference frame of the ball, with the air rushing by. Suppose the ball is rotating counterclockwise. A thin layer of air is being dragged around by the ball. We are looking down in the ba

Lack of blood to the brain

In medicine, one of many applications of Bernoulli’s principle is to explain a TIA, a transient ischemic attack (meaning a temporary lack of blood supply to the brain). A person suffering a TIA may experience symptoms such as dizziness, double vision, headache and a weakness of the limbs. A TIA can occur as follows. Blood normally flows up to the brain at the back of the head via the two vertebral arteries – one going up each side of the neck – which meet to form the basilar artery just below the brain. The vertebral arteries issue from the subclavian arteries before the latter pass to the arms. When as arm is exercised vigorously, blood flow increases to meet the needs of the arm’s muscles. If the subclavian artery on one side of the body is partial blocked, however, as in arteriosclerosis (hardening of the arteries), the blood velocity will have to be higher on that side to supply the needed blood. The increase blood velocity past the opening to the vertebral artery results in lower pressure (Bernoulli’s principle). Thus, blood rising in the vertebral artery on the “ good” side at normal pressure can be diverted down into the other vertebral artery because of the low pressure on that side, instead of passing upward to the brain. Hence the blood supply to the brain is reduced.

Other Applications

A venture tube is essentially a pipe with a narrow constriction (the throat). The flowing air speeds up as it passes through this constriction, so the pressure is lower in the throat. A venturi meter, is used to measure the flow speed f gases and liquids, including blood velocity in arteries. Why does smoke go up a chimney? It’s partly because hot air rises (it’s less dense and therefore buoyant). But Bernoulli’s principle also plays a role. When wind blows across the top of the chimney, the pressure is less there than inside the house. Hence, air and smoke are pushed up the chimney by the higher indoor pressure. Even on an apparently still night there is usually enough ambient air flow at the top of a chimney to assist upward flow of smoke.

If gophers, prairie

Bernoulli's principle, physical principle formulated by Daniel Bernoulli that states that as the speed of a moving fluid (liquid or gas) increases, the pressure within the fluid decreases. The phenomenon described by Bernoulli's principle has many practical applications; it is employed in the carburetor and the atomizer, in which air is the moving fluid, and in the aspirator, in which water is the moving fluid. In the first two devices air moving through a tube passes through a constriction, which causes an increase in speed and a corresponding reduction in pressure. As a result, liquid is forced up into the air stream (through a narrow tube that leads from the body of the liquid to the constriction) by the greater atmospheric pressure on the surface of the liquid. In the aspirator air is drawn into a stream of water as the water flows through a constriction. Bernoulli's principle can be explained in terms of the law of conservation of energy (see conservation laws, in physics). As a fluid moves from a wider pipe into a narrower pipe or a constriction, a corresponding volume must move a greater distance forward in the narrower pipe and thus have a greater speed. At the same time, the work done by corresponding volumes in the wider and narrower pipes will be expressed by the product of the pressure and the volume. Since the speed is greater in the narrower pipe, the kinetic energy of that volume is greater. Then, by the law of conservation of energy, this increase in kinetic energy must be balanced by a decrease in the pressure-volume product, or, since the volumes are equal, by a decrease in pressure.

Daniel Bernoulli formulated a principle that states that as the velocity of moving fluid or gas is increased, the pressure within the fluid or gas is decreased. Bernoulli's principle has in fact many practical applications; it is applied in the carburetor and the atomizer, in which air acts as the moving fluid, and in the aspirator, water is acting as the moving fluid. In the carburetor and atomizer, air travelling through a tube goes through a constriction, which causes an increase in the velocity, and a decrease in the pressure. As a result, the liquid is forced up into the air stream (through a narrow tube that leads from the body of the liquid to the constriction) by the greater atmospheric pressure acting on the liquid.

In modern everyday life there are many observations that can be successfully explained by application of Bernoulli's principle, even though no real fluid is entirely inviscid [19] and a small viscosity often has a large effect on the flow.

Bernoulli's Principle can be used to calculate the lift force on an airfoil if you know the behavior of the fluid flow in the vicinity of the foil. For example, if the air flowing past the top surface of an aircraft wing is moving faster than the air flowing past the bottom surface then Bernoulli's principle implies that the pressure on the surfaces of the wing will be lower above than below. This pressure difference results in an upwards lift force.[nb 1]HYPERLINK "#cite_note-20″[20] Whenever the distribution of speed past the top and bottom surfaces of a wing is known, the lift forces can be calculated (to a good approximation) using Bernoulli's equations[21] – established by Bernoulli over a century before the first man-made wings were used for the purpose of flight. Bernoulli's principle does not explain why the air flows faster past the top of the wing and slower past the underside. To understand why, it is helpful to understand circulation, the Kutta condition, and the Kutta-Joukowski theorem.

The carburetor used in many reciprocating engines contains a venturi to create a region of low pressure to draw fuel into the carburetor and mix it thoroughly with the incoming air. The low pressure in the throat of a venturi can be explained by Bernoulli's principle; in the narrow throat, the air is moving at its fastest speed and therefore it is at its lowest pressure.

The Pitot tube and static port on an aircraft are used to determine the airspeed of the aircraft. These two devices are connected to the airspeed indicator which determines the dynamic pressure of the airflow past the aircraft. Dynamic pressure is the difference between stagnation pressure and static pressure. Bernoulli's principle is used to calibrate the airspeed indicator so that it displays the indicated airspeed appropriate to the dynamic pressure.[22]

The flow speed of a fluid can be measured using a device such as a Venturi meter or an orifice plate, which can be placed into a pipeline to reduce the diameter of the flow. For a horizontal device, the continuity equation shows that for an incompressible fluid, the reduction in diameter will cause an increase in the fluid flow speed. Subsequently Bernoulli's principle then shows that there must be a decrease in the pressure in the reduced diameter region. This phenomenon is known as the Venturi effect.

The maximum possible drain rate for a tank with a hole or tap at the base can be calculated directly from Bernoulli's equation, and is found to be proportional to the square root of the height of the fluid in the tank. This is TorricelliHYPERLINK " http://en. wikipedia. org/wiki/Torricelli's_law"' HYPERLINK " http://en. wikipedia. org/wiki/Torricelli's_law" s law, showing that Torricelli's law is compatible with Bernoulli's principle. Viscosity lowers this drain rate. This is reflected in the discharge coefficient which is a function of the Reynold's number and the shape of the orifice.[23]

In open-channel hydraulics, a detailed analysis of the Bernoulli theorem and its extension were recently developed.[24] It was proved that the depth-averaged specific energy reaches a minimum in converging accelerating free-surface flow over weirs and flumes (also [25]HYPERLINK "#cite_note-Chanson2006-26″[26]). Further, in general, a channel control with minimum specific energy in curvilinear flow is not isolated from water waves, as customary state in open-channel hydraulics.

The principle also makes it possible for sail-powered craft to travel faster than the wind that propels them (if friction can be sufficiently reduced). If the wind passing in front of the sail is fast enough to experience a significant reduction in pressure, the sail is pulled forward, in addition to being pushed from behind. Although boats in water must contend with the friction of the water along the hull, ice sailing and land sailing vehicles can travel faster than the wind.[27]HYPERLINK "#cite_note-28″[28]

Bernoulli's Principle