SPECTRO MECH-2018

DEPARTMENT OF MECHANICAL ENGINEERING

TECHNIQUE POLYTECHNIC INSTITUTE , HOOGHLY

AN APPLICATIONS OF MECHANICAL ENGINEERING

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Mission of the Institution

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- To improve the quality of skilled workforce through a structured programme and professional skills training
- To inspire students to learn and facilitate their overall development with social orientation and values

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FOREWORD

Greetings and a warm welcome to our fourth edition of Mechanical Engineering Technical magazine 'SPECTRO MECH' in 2018. We excited to report that the Department of Mechanical Engineering continues to grow to meet our vision of the department which is analyze by Faculty Course Assessment Report(FCAR). Mechanical Engineering is one of the largest enrolled department in the collage with more than 230 under graduate student over the period of 2010-2018 more than 150 students are already placed at various companies as well as higher studies. All the initiatives are possible by the generous contributions of alumni, friends, faculty members and staff.

I would like to express my appreciation to all the authors of the article in this issue of the Magazine. Our goal is to create quality education for the student of the twenty first century. The success of 'SPECTRO MECH' depends on energetic and joint effort of all stake holders of the Institution. I would appreciate your feedback and any suggestion for improvement.

SoumendraNath Basu
Executive Director
Technique Polytechnic Institute

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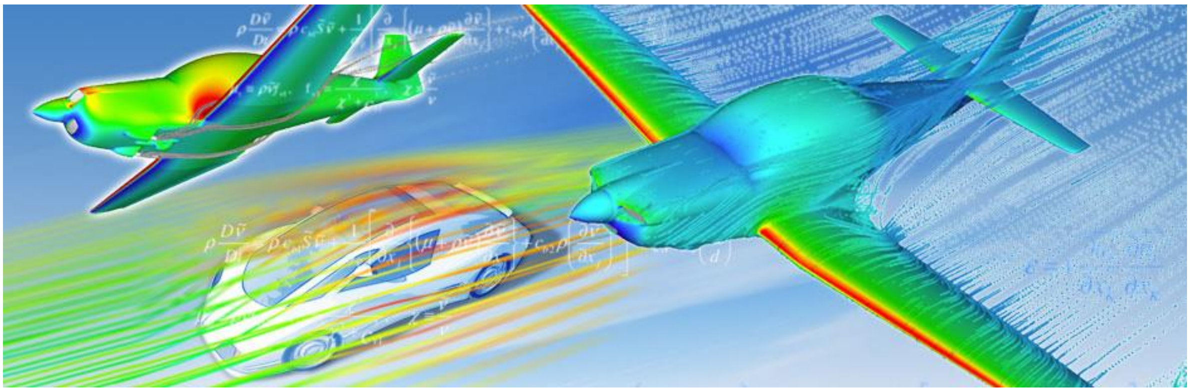
APPLICATION OF FLUID MECHANICS IN AERODYNAMICS

By Ranajay Maji

...Lecturer, Department of Mechanical Engineering

A life on earth is one lived while being constantly immersed in fluid (usually Gas and Liquid). Fluid mechanics problems surround us, literally, and their study and solution is fundamental to many engineering and applied physics investigations.

Fluids are deformable to an unlimited extent, and yield in time to very small disturbance forces. Consequently, their motions are frequently very complex, and even rather straightforward fluid flow configurations can produce flow fields with non-trivial solutions displaying very complicated dynamics.



Despite the fact that the governing equations are usually well known, the vast majority of fluid flows cannot be solved directly by brute force calculation and the subject requires a close collaboration between theory and experiment. This coupled effort, together with increasingly effective use of carefully-selected, large-scale, direct numerical simulations on the computer, results in a field which has remained vigorous, challenging and exciting for over a century.

Progress in understanding and predicting the aerodynamics of flow over wings and bodies during this time period has been spectacular, following exactly this mix of experiment and empirical discovery, together with simple and non-simple flow models. While aerodynamics is at the core of all aerospace engineering programs, the broader discipline of fluid mechanics,encompassing both aero- and hydrodynamics, covers a vast array of topics.

The range and variety of fluid mechanics problems is both breathtaking and refreshing. The diversity is reflected in the Aerospace Engineering Department at USC, which has active research and advanced teaching on many of these fronts.

Aerodynamics, is that branch of physics that deals with the motion of air and other gaseous fluids and with the forces acting on bodies passing through such a fluid. Aerodynamics seeks, in particular, to explain the principles governing the flight of aircraft, rockets, and missiles. It is also concerned with the design of automobiles, high-speed trains, and ships, as well as with the construction of such structures as bridges and tall buildings to determine their resistance to high winds.

History

Observations of the flight of birds and projectiles stirred speculation among the ancients as to the forces involved and the manner of their interaction. They, however, had no real knowledge of the physical properties of air, nor did they attempt a systematic study of those properties. Most of their ideas reflected a belief that the air provided a sustaining or impelling force. These notions were based to a large degree on the principles of hydrostatics (the study of the pressures of liquids) as they were then understood. Thus, in early times, it was thought that the impelling force of a projectile was associated with forces exerted on the base by the closure of the flow of air around the body. This conception of air as an assisting medium rather than a resisting force persisted for centuries, even though in the 16th century it was recognized that the energy of motion of a projectile was imparted to it by the catapulting device.

Evolution

Near the end of the 15th century, Leonardo Da-Vinci observed that air offered resistance to the movement of a solid object and attributed this resistance to compressibility effects. Galileo later established the fact of air resistance experimentally and arrived at the conclusion that the resistance was proportional to the velocity of the object passing through it. In the late 17th century, Christiaan Huygens and Sir Isaac Newton determined that air resistance to the motion of a body was proportional to the square of the velocity.

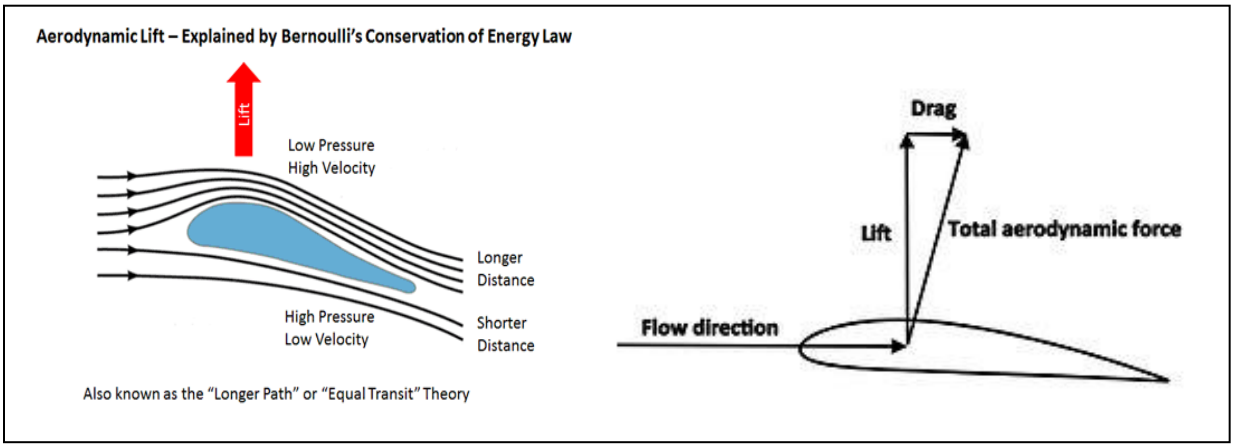
Newton's work in setting forth the laws of mechanics marked the beginning of the classical theories of aerodynamics. He considered the pressure acting on an inclined plate as arising from the impingement of particles on the side of the plate that faces the airstream. His formulation yielded the result that the pressure acting on the plate was proportional to the product of the density of the air, the area of the plate, the square of the velocity, and the square of the sine of the angle of inclination. This failed to account for the effects of the flow on the upper surface of the plate where low pressures exist and from which a major portion of the lift of a wing is produced. The idea of air as a continuum with a pressure field extending over great distances from the plate was to come much later.

Various discoveries were made during the 18th and 19th centuries that contributed to a better understanding of the factors influencing the movement of solid bodies through air. The relationship of resistance to the viscous properties of a fluid, for example, was perceived in part by the early 1800s, and the experiments of the British physicist Osborne Reynolds in the 1880s brought into clearer view the significance of viscous effects.

Modern aerodynamics emerged about the time that the Wright brothers made their first powered flight (1903). Several years after their historic effort, Frederick W. Lanchester, a British engineer, proposed a circulation theory of lift of an airfoil of infinite span and a vortex theory of the lift of a wing of finite span. The German physicist Ludwig Prandtl, commonly regarded as the father of modern aerodynamics, arrived independently at the same hypotheses as Lanchester and developed the mathematical treatment. Prandtl's work, refined and expanded by subsequent investigators, formed the theoretical foundation of the field. Among others who played a prominent role in the development of modern aerodynamics was the Hungarian-born engineer Theodore von Kármán, whose contributions led to major advances in such areas as turbulence theory and supersonic flight.

One other representative of the 20th century who deserves mention here besides Prandtl is Geoffrey Taylor of England. Taylor remained a classical physicist while most of his contemporaries were turning their attention to the problems of atomic structure and quantum mechanics, and he made several unexpected and important discoveries in the field of fluid mechanics. The richness of fluid mechanics is due in large part to a term in the basic equation of the motion of fluids which is nonlinear—*i.e.*, one that involves the fluid velocity twice over. It is characteristic of systems described by nonlinear equations that under certain conditions they become unstable and begin behaving in ways that seem at first sight to be totally chaotic. In the case of fluids, chaotic behavior is very common and is called turbulence. Mathematicians have now begun to recognize patterns in chaos that can be analyzed fruitfully, and this development suggests that fluid mechanics will remain a field of active research well into the 21st century. (For a discussion of the concept of chaos, see physical science, principles of.)

Concept of drag and lift



Bernoulli's Theory of Flight

The Theory of Flight is often explained in terms **Bernoulli's Equation** which is a statement of the **Conservation of Energy**. It states that:

- For a non-viscous, incompressible fluid in steady flow, the sum of pressure, potential and kinetic energies per unit volume is constant at any point. In other words, ignoring the potential energy due to altitude:
- When the velocity of a fluid increases, its pressure decreases by an equivalent amount to maintain the overall energy. This is known as **Bernoulli's Principle**

According to Bernoulli's Principle, the air passing over the top of an aerofoil or wing must travel further and hence faster that air the travelling the shorter distance under the wing in the same period but the energy associated with the air must remain the constant at all times. The consequence of this is that the air above the wing has a lower pressure than the air below the wing and this pressure difference creates the lift.

Unfortunately Bernoulli's Principle does not explain how an aero plane can fly upside down. Nor does it explain how aircraft and other structures with flat plate wings or even kites and paper aero planes can fly or remain airborne.

Newton's Theory of Flight

Isaac Newton did not propose a theory of flight but he did provide **Newton's Laws of Motion** the physical laws which can be used to explain aerodynamic lift.

Newton's Second Law states that:

- The force on an object is equal to its mass times its acceleration or equivalently to its rate of change of momentum

F = M a = d/dt (M v)

In other words, whenever there is a change of momentum, there must be a force causing it. In this case, since momentum is a vector quantity, the change in direction of the airflow around the wing must be associated with a force on the volume of air involved.

Newton's Third Laws states that:

- To every action there is an equal and opposite reaction.

This means that the force of the aerofoil pushing the air downwards, creating the **downwash**, is accompanied by an equal and opposite force from the air pushing the aerofoil upwards and hence providing the aerodynamic lift.

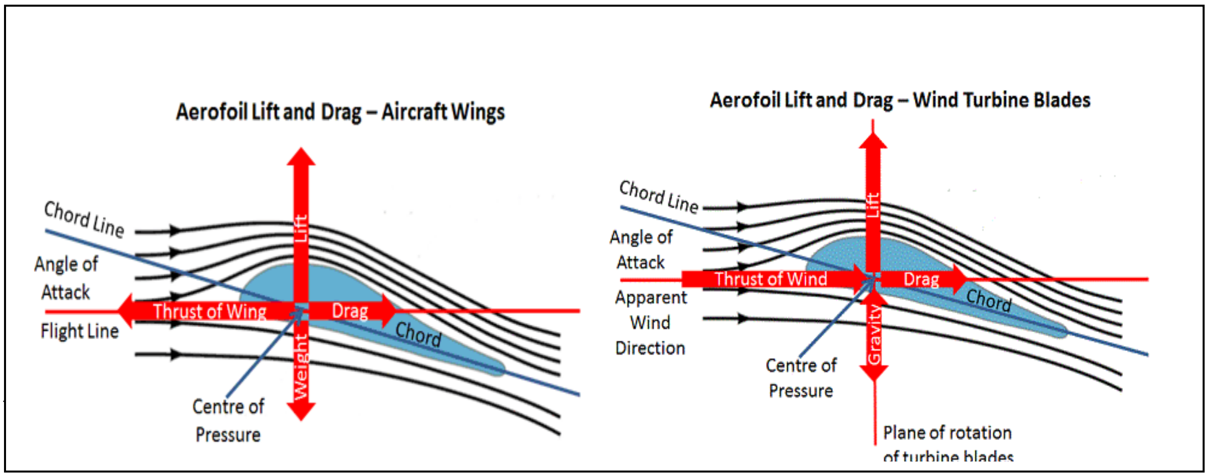
It is thus the **turning** of the air flow which creates the lift.

Aircraft Wings

Aircraft are kept in the air by the forward thrust of the wings or aerofoil's, through the air. The thrust driving the wing forward is provided by an external source, in this case by propellers or jet engines.

The result of the movement of the wing through stationary air is a lift force perpendicular to the motion of the wing, which is greater than the downwards gravitational force on the wing and so keeps the aircraft airborne. The lift is accompanied by drag which represents the air resistance against the wing as it forces its way through the air. The drag is dependent on the effective area of the wing facing directly into the airflow as well as the shape of the aerofoil.

The magnitudes of the lift and drag are dependent on the angle of attack between the direction of the motion of the wing through the air and the chord line of the wing.



Wind Turbines extract energy from the force of the wind on an aerofoil, in this case a turbine blade. The relative motion between the air flow and the turbine blade, is the same as for the aircraft wing, but in this case the wind is in motion towards the turbine blades and the blades are passive so that the external thrust provided by the moving air flow is in the opposite direction to the thrust provided by the aircraft wing. The turbine blades thus experience lift and drag forces, similar to the aircraft wing, which set the blades in motion transferring the wind energy into the kinetic energy of the blades

The turbine blades are connected to a single rotor shaft and the force of the wind along the length of the blades creates a torque which turns the rotor.

As with aircraft wings, the magnitudes of the lift and drag on the turbine blade are dependent on the angle of attack between the apparent wind direction and the chord line of the blade.

See more details about Apparent Wind Direction

The dynamics of wind turbines is however slightly more complex than the dynamics of a simple wing because the direction of the gravitational force on the turbine blade changes with the rotation of the turbine rotor.

In a "theoretical" turbine with a single blade operating with a constant wind force, the magnitude and direction of the lift and drag with respect to the aerofoil profile will be constant throughout the full 360° rotation of the turbine rotor but the direction of the lift with respect to the ground will depend on the position of the rotor. The magnitude of the gravitational force on the blade will also be constant for any position of the rotor but the horizontal position of the centre of gravity of the blade with respect to the centre of the rotor will vary as the rotor turns. The net effect of these forces on the rotor torque depends on the position of the rotor.

- When the blade is horizontal and moving upwards it is moving against the force of gravity which is pulling the blade downwards so that the net lifting force on the blade and the resulting torque on the rotor is reduced.
- After 180° rotation of the rotor, the blade is once more horizontal but upside down and moving downwards so that the"lifting force" due to the wind is in the opposite direction and reinforces the downwards gravitational force so that the torque on the rotor is increased.
- When the blade is vertical, either at the top or the bottom of its cycle, the gravitational force is perpendicular to the lifting force and passes through the centre of the rotor shaft and hence has no effect on the torque which is purely due to lift.

Angle of Attack

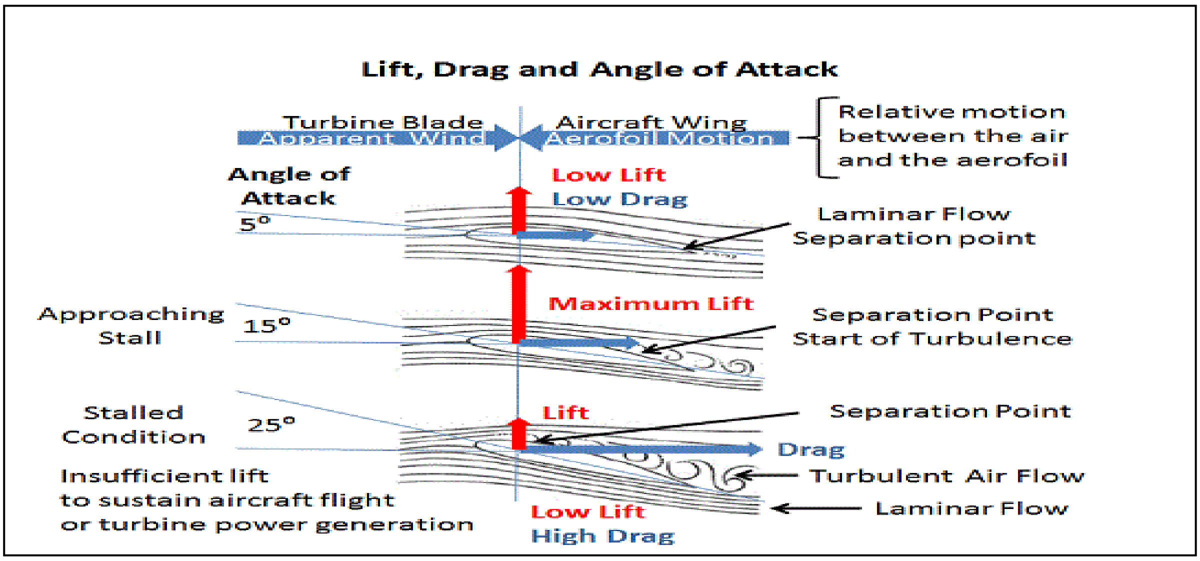
The angle of attack of a turbine blade is the angle between the direction of the apparent or relative wind and the chord line of the blade. For an aircraft wing, it is the angle between the direction of motion of the wing and the chord line of the wing.

At very low angles of attack, the airflow over the aerofoil is essentially smooth and laminar with perhaps a small amount of turbulence occurring at the trailing edge of the aerofoil. The point at which laminar flow ceases and turbulence begins is known as the separation point.

Increasing the angle of attack increases the area of the aerofoil facing directly into the wind. This increases the lift but it also moves the separation point of laminar flow of the air above the aerofoil part way up towards the leading edge and the result of the increased turbulent flow above the aerofoil is an increase in the drag.

Maximum lift typically occurs when the angle of attack is around 15 degrees but this could be higher for specially designed aerofoils.

Above 15 degrees, the separation point moves right up to the leading edge of the aerofoil and laminar flow above the aerofoil is destroyed. The increased turbulence causes the rapid deterioration of the lift force while at the same time it dramatically increases the drag, resulting in a stall.



Applications

For all bodies in motion, there is an associated fluid flow, whether the body is pushing against a solid surface (automobiles, trucks, trains, cyclists, cheetahs), or against the surrounding medium (airplanes, birds, Frisbees, ships, submarines, dolphins, fish). The body may be at rest in a moving fluid (mountains, islands, skyscrapers, ocean platforms, flagpoles, bridge towers, pylons, trees, mussels). The fluid motion may be internal, involving transport processes (internal combustion engines, cooling and ventilation systems, flows in the blood vessels and lungs). The scales can be very large (planetary scale motions — atmospheric and ocean circulations on earth, turbulence on galactic scales), or very small (circulation and transport in micro machines, bubble and particle motions). In many practical applications, a very large range of scales spanning many orders of magnitude are simultaneously present. Flow at interfaces between different fluids can generate a rich set of phenomena (ocean surface waves, oil/water mixtures in petroleum extraction, bubbly flows, combustion and chemical mixing).

NEED OF TRIBOLOGY AS A SUBJECT

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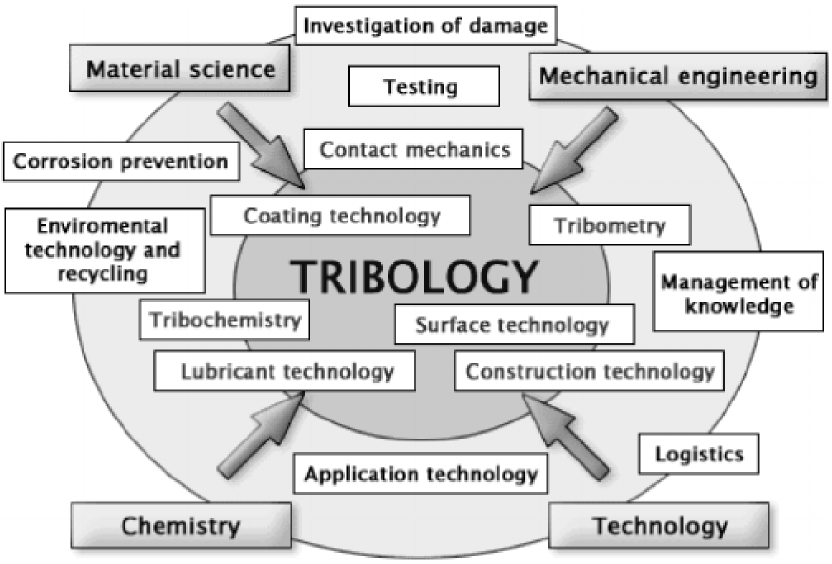
Tribology is the science and engineering of interacting surfaces in relative motion. It includes the study and application of the principles of friction, lubrication and wear. Tribology is highly interdisciplinary. It draws on many academic fields, including physics, chemistry, materials science, mathematics, biology and engineering.
The understanding of tribology is a great way ofconserving the energy. By reducing the coefficient offriction and wear rate greatly saves our resources. Also thedevelopment of eco-friendly materials and biodegradable
Lubricants can help in the sustainability.

History of Tribology

• September 1964 -- Conference on Lubrication in Iron and Steel Works in Cardiff (UK). Realization of considerable losses due to lack of knowledge related friction and wear of machine components.
• After this realization UK Minister of State for science formed a committee to investigate the education, research and the need of industry related to lubrication.
• Committee after deliberations concluded that only lubrication engineering could not provide complete solution to deal with friction and wear of machine components. An interdisciplinary approach embracing solid and fluid mechanics, chemistry, and material science is essential. Since there was no word for such new concept, a new name "Tribology" was coined in 1966.



• After 1966, the word "Tribology" has been used for :
1. Basic mechanisms governing interfacial behavior.
2. Basic theories quantifying interfacial mechanisms.
3. Solutions to friction and wear problems.

• Major breakthrough in tribological science came in 1981 with development of "Scanning tunneling microscope"(STM) and systematic theory based on "Contact mechanics". Such developments provided tools to predict and estimate the behaviour of a single asperity contact.

• Subsequent development of Atomic Force Microscope(AFM) in 1985 allowed measurement (surface topography, friction force) of all engineering surfaces. Atomic Force Microscope can be used for studies of adhesion, scratching, wear, lubrication, surface temperatures and measurements of elastic/plastic mechanical properties.

• The developments of tip-based microscopes (STM & AFM) and computational techniques for simulating tip-surface interactions and interfacial properties, have allowed systematic investigations for interfacial problems. Modifying and manipulating surface microstructure provide a bridge between science and engineering.

General Application of Tribology

The common industrial tribological components include: Bearings , cams , gears , automobile engines and cutting tools.

Tribology of Bearings

In mechanical systems, bearings are used for supporting the various rotating elements like shafts etc. Journal bearings are used for supporting the cylindrical rotating shafts. A special feature of journal bearings is that it makes metal to metal contact only in two conditions, one at the start of rotation and other at the end of rotation. Only in these two conditions, wear of journal bearings takes place.

Tribology of Gears

Gears are very important for transmitting the power from one shaft to other shaft and used in large number of applications. So, we have to investigate various tribological aspects of gear like reasons for failure and methods of preventing these failures. As, we know that maximum deterioration of gears takes place on surface of gears as teeth are responsible for power transmission. So, we have to do some surface modifications so that failure of gears can be avoided to some extent.

Tribology in Cams

In internal combustion engines, Cam and Follower is an important component. As they perform their desired functions by making a continuous contact between themselves. So, due to this continuous contact, there are large chances of wear on surfaces which leads to failure of cams and follower before the predetermined life.

Tribology in Automobile Engines

The most important tribological component in the automobiles is the engine. It is because maximum amount of fuel energy is lost in the engine. A part of the fuel energy is lost as friction. Almost 15% of the fuel energy is lost as mechanical losses. It has been seen that if mechanical losses are reduced by 10% in automobiles, the fuel consumption will be reduced by 1.5%.

Tribology of Metal Working Fluids

Metal working fluids are used for the providing cooling and lubricating effect in different cutting operations such as turning, milling, grinding etc. if the MWF's are not used there be wear of the interacting surfaces leading to the failure of operations.

Modern Applications of Tribology:

Biomedical (Biotribology)

The application of tribology in biological systems is a rapidly growing field and extends well beyond the conventional boundaries. Biomedical tribological systems involve an extensive range of synthetic materials and natural tissues, including cartilage, blood vessels, heart, tendons, ligaments, and skin.

Nano-tribology

The commercialization of micro-electromechanical systems (MEMS)/nano-electromechanical systems (NEMS), such as disk drives and other magnetic storage systems in the early 1990s, along with the development of new materials with nano scale thicknesses, have presented new tribological challenges.

Some of these applications include chemical and bio detectors, advanced drug delivery systems, information recording layers, molecular sieves, systems on a chip, nanoparticle reinforced materials, and a new generation of lasers.

Wind Turbines

Wind turbines continue to hold promise as a viable alternative energy source. While they have made gains in reliability in the past decade, they are subject to tribological problems that are difficult and costly to repair and can drastically reduce their expected lifecycles. Two key areas of concern are reliability of gearboxes and turbine lubrication.

Green Tribology

The concept of "green tribology" was also introduced by Jost, who defined it as, "The science and technology of the tribological aspects of ecological balance and of environmental and biological impacts."

HEAT TREATMENT PROCESSES

SUJIT KUMAR GARAI
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It is impossible to determine the precise number of steel compositions and other variations that presently exist, although the total number probably exceeds 1000; thus, any rigid classification is impossible. According to American Iron and Steel Institute (AISI) steels are arbitrarily divided into five groups, which has proved generally satisfactory to the metalworking community. These five classes are:1) Carbon steels 2) Alloy steels (sometimes referred to as low-alloy steels) 3) Stainless steels 4) Tools steels 5) Special-purpose steels.Steel is an important material because of its tremendous flexibility in metal working and heat treating to produce a wide variety of mechanical, physical, and chemical properties. Pure iron solidifies from the liquid at 1538 _C (2800 _F) (top of Fig.1). A crystalline structure, known as ferrite, or delta iron, is formed (point a, Fig. 1). This structure, in terms of atom arrangement, is known as a body-centered cubic lattice (bcc), shown in Fig. 2(a). This lattice has nine atoms—one at each corner and one in the center. As cooling proceeds further and point b (Fig. 1) is reached (1395 _C, or 2540 _F), the atoms rearrange into a 14-atom lattice a shown in Fig.2(b). The lattice now has an atom at each corner and one at the center of each face. This is known as a face-centered cubic lattice (fcc), and this structure is called *gamma iron.* As cooling further proceeds to 910 _C (1675 _F) (point c, Fig. 1), the structure reverts to the nine-atom lattice or alpha iron. The change at point d on Fig. 1 (770 _C, or 1420 _F) merely denotes a change from nonmagnetic to magnetic iron and does not represent a phase change. The entire field below 910 _C (1675 _F) is composed of alpha ferrite, which continues on down to room temperature and below. The ferrite forming above the temperature range of austenite is often referred to as *delta ferrite*; that forming below A3 as *alpha ferrite,* though both are structurally similar. In this Greek-letter sequence, austenite is gamma iron, and the interchangeability of these terms should not confuse the fact that only two structurally distinct forms of iron exist. Figures 1 and 2 thus illustrate the allotropy of iron.

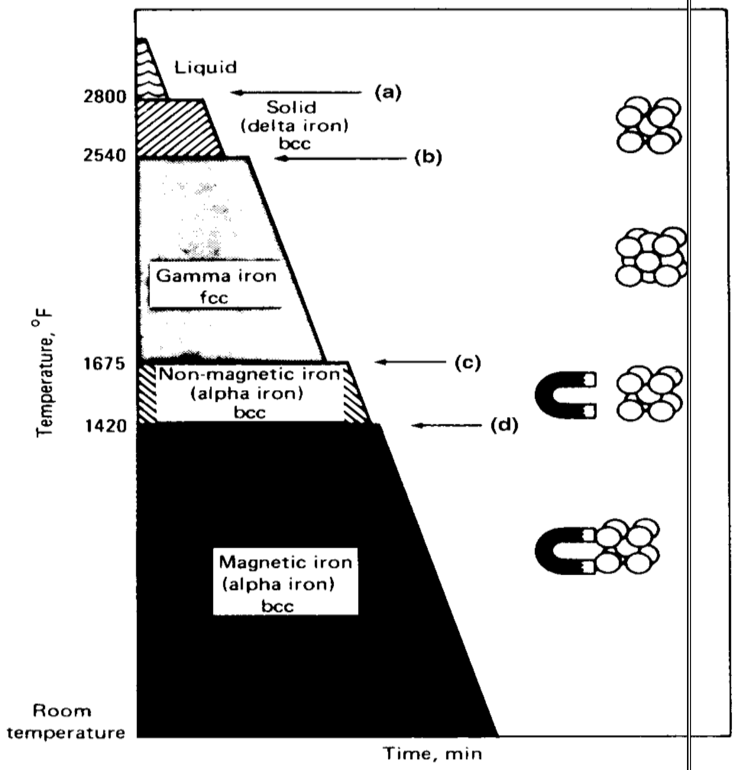

Figure 1 Changes in pure iron as it cools from the molten state to room temperature.

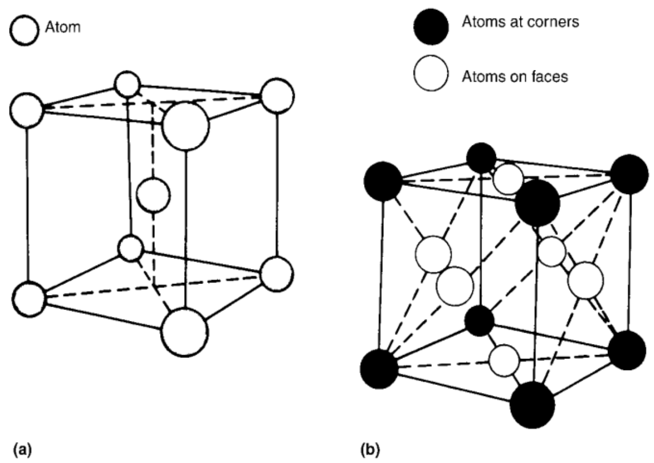

Fig. 2 Arrangement of atoms in the two crystalline structures of pure iron.
(a) Body-centered cubic lattice. (b) Face-centered cubic lattice

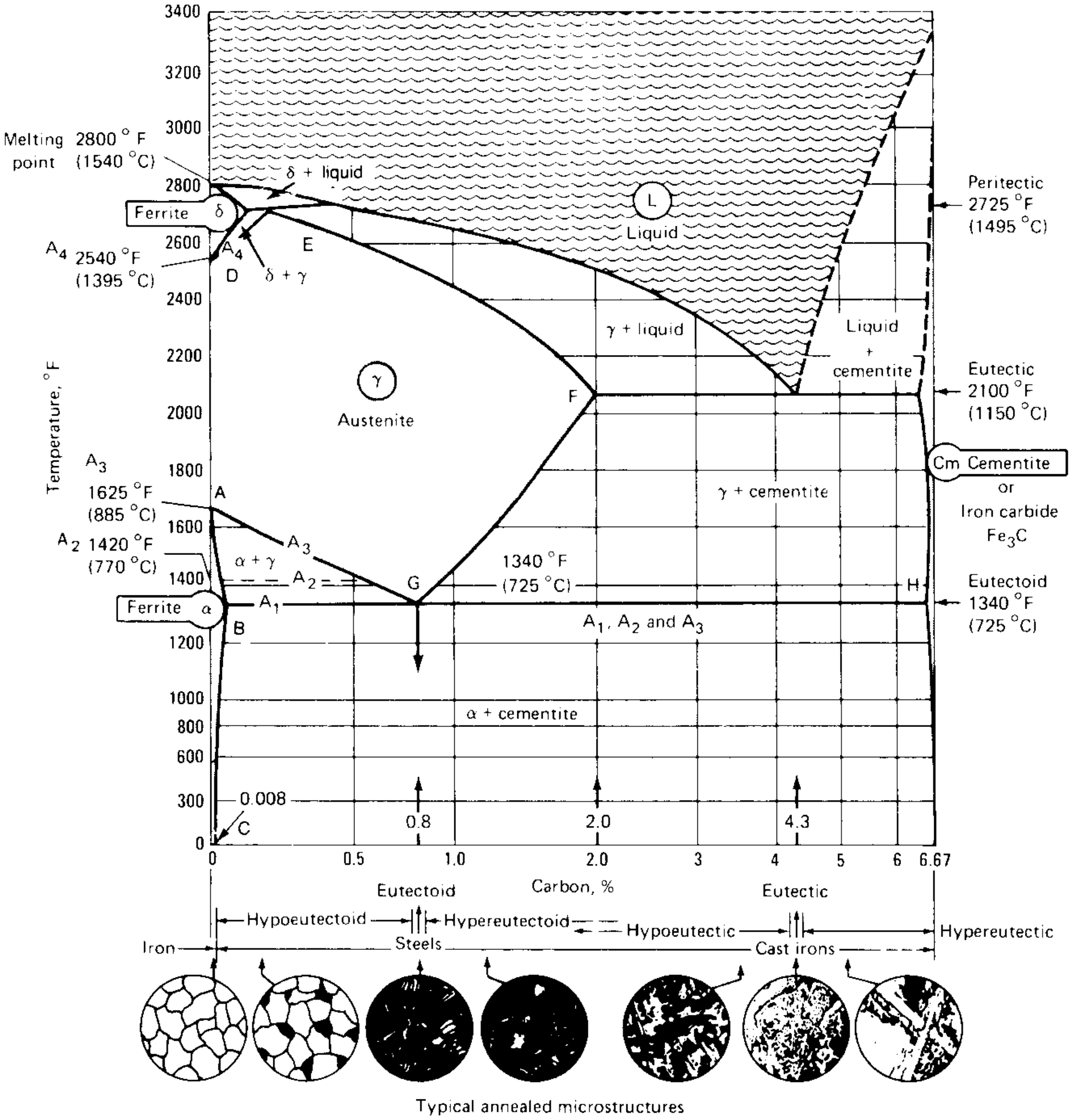

Fig. 3 Iron-cementite phase diagram

A phase diagram is a graphical representation of the equilibrium temperature and composition limits of phase fields and phase reactions in an alloy system. In the iron-cementite system, temperature is plotted vertically, and composition is plotted horizontally. The iron-cementite diagram (Fig. 3), deals only with the constitution of the iron-iron carbide system, i.e., what phases are present at each temperature and the composition limits of each phase. Any point on the diagram, therefore, represents a definite composition and temperature, each value being found by projecting to the proper reference axis. Although this diagram extends from a temperature of 1870 _C (3400 _F) down to room temperature, note that part of the diagram lies below 1040 _C (1900 _F). Steel heat treating practice rarely involves the use of temperatures above 1040 _C (1900 _F). In metal systems, pressure is usually considered as constant.

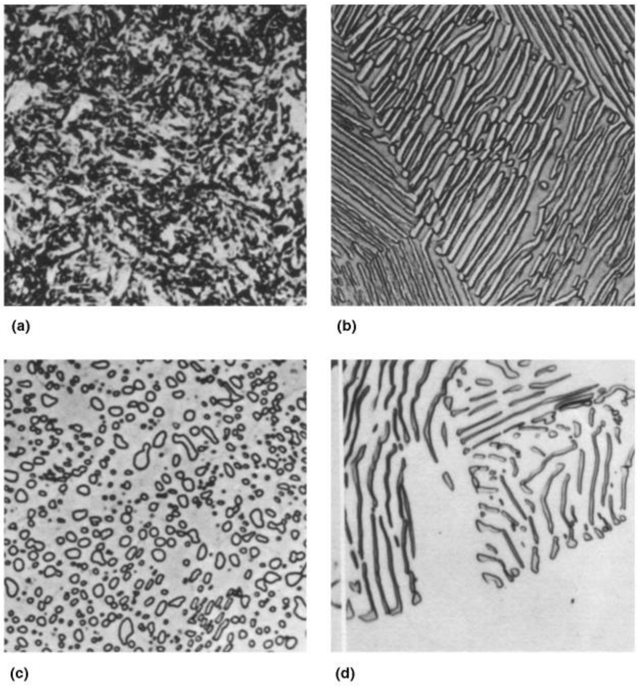

Fig. 4 Effects of carbon content on the microstructures of plain-carbon steels.(a) Ferrite grains (white) and pearlite (gray streaks) in a white matrix of a hypoeutectoid steel containing 0.4% C. (b) Microstructure (all pearlite grains) of a eutectoid steel containing 0.77% C. (c) Microstructure of a eutectoid steel containing 0.77% C with all cementite in the spheroidal form. (d) Microstructure of a hypereutectoid steel containing 1.0% C containing pearlite with excess cementite bounding the grains.

The critical temperatures (A1, A6, and Acm) are "arrests" in heating or cooling and have been symbolized with the letter A, from the French word arret meaning arrest or a delay point, in curves plotted to show heating or cooling of samples. Such changes occur at transformation temperatures in the iron-cementite diagram if sufficient time is given and cab be plotted for steels showing lags at transformation temperatures, as shown for iron in Fig. 4. However, because heating rates in commercial practice usually exceed those in controlled laboratory experiments, changes on heating usually occur at temperatures a few degrees above the transformation temperatures shown in Fig. 4 and are known as Ac temperatures, such as Ac1 or Ac3. The "c" is from the French word chauffage, meaning heating.
Thus, Ac1 is a few degrees above the ideal A1 temperature. Likewise, on slow cooling in commercial practice, transformation changes occur at temperatures a few degrees below those in Fig. 4. These are known as Ar, or Ar3, the "r" originating from the French word refroidissement, meaning cooling. This difference between the heating and cooling varies with the rate of heating or cooling. The faster the heating, the higher the Ac point; the faster the cooling, the lower the Ar point. Also, the faster the heating and cooling rate, the greater the gap between the Ac and Ar points of the reversible (equilibrium) point A. Going one step further, in cooling a piece of steel, it is of utmost importance to note that the cooling rate may be so rapid (as in quenching steel in water) as to suppress the transformation for several hundreds of degrees. This is due to the decrease in reaction rate with decrease in temperature. As discussed subsequently, time is an important factor in transformation, especially in cooling.

The foregoing discussion has been confined principally to phases that are formed by various combinations of composition and temperature; little reference has been made to the effects of time. In order to convey to the reader the effects of time on transformation, the simplest approach is by means of a time-temperature-transformation (TTT) curve for some constant iron-carbon composition.

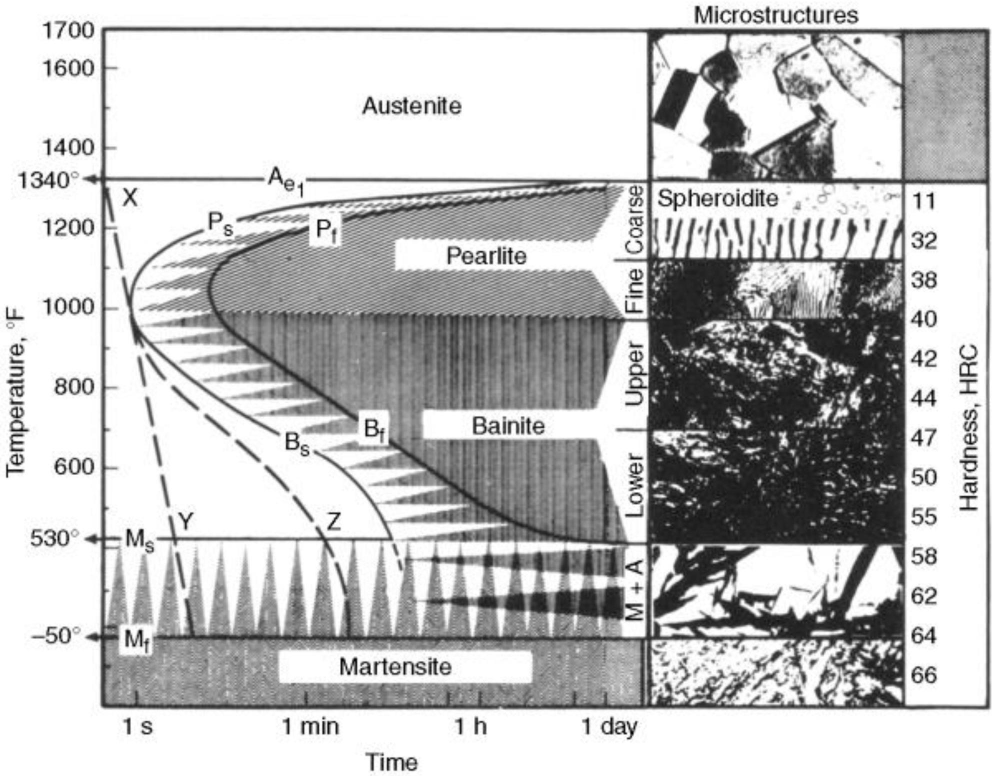

Fig. 5 Time-temperature-transformation (TTT) diagram for a eutectoid (0.77%) Carbon steel

(a) (b)

Fig. 6 (a) Microstructure of quenched 0.95% carbon steel. Structure is martensitic. (b) Bainitic structure in a quenched 0.95% carbon steel.

Conclusion

From the above study it is concluded that according to need of Industry the engineer can design a proper route for heating and cooling during manufacturing steel. The Iron Carbon Equilibrium diagram and TTT diagram are the basic tools for designing the manufacturing process of steel and cast iron.

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INVENTRY CONTROL TECHNIQUE

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I. INTRODUCTION

Material is one of the main resources of the production system. Due to shortage of raw materials the small scale manufacturing units fail to continuity their production system. This shortage of materials found due to lack of inventory control technique. Inventory is a list of any items or resources used in organization. Inventory control is a technique which regulates the flow of inventories from one department to other. This technique is used different company to reduce excess materials cost. The purpose of the technique is to determine the quantity to keep in the store & how much to order and when to order to meet the customer demand. SMEs are base of the manufacturing unit. In the developing country, it brings growth in economy because many low educated people are employed in this type of sectors who earns their livelihood from this organization. If this organisation runs smoothly following the inventory control system then the uneducated people will able settle their earning opportunity. As a result the production system of the organisation will be dynamic in nature.

II. OBJECTIVES OF INVENTORY CONTROL

This technique is heart of the organization having different reasons:

It - i) gives employment opportunity

ii) reduces capital investment in comparatively less important items
iii) improves dynamism in production system

iv) reduces shortage and wastage of materials
v) increase efficiency & profitability of the organization
vi) satisfy customer demands always

III. LITERATURE SURVEY

Onwubolu et al. (2006) stated ABC (Always Better Control) analysis tends to measure the significance of each item of inventory in terms of value. When the ABC (Always Better Control) analysis is applied to an inventory situation, it shows the importance of items and level of control placed on the items. Inventories form a significant portion of the current assets of manufacturing enterprises (Kruger, 2005). The management of inventories has an important bearing on the financial strength and competitiveness of a manufacturing enterprise due to the reason that it directly affects the working capital, production and customer services (Virgin, 1998). According to Jegede (1992) stated that the necessity of keeping stock arises because of the time lapse between purchasing, production and eventual sale to customers. The major concern is how inventory can be controlled to minimize waste and cost. Forgionne (1986) stressed that inventory policy involves resolving organisational conflicts since all departments connected with inventory in the organization have different views of what quantity of inventory to keep. Sound management should consider all view points and develop a policy that minimise total related inventory cost. According to Kotler, 2002, the problem of inventory has continued to receive much attention in most businesses. Inventory levels of raw materials, semi-finished and finished goods need to be effectively managed to control the cost of inventory.

IV.CASE STUDY

XYZ is a small manufacturing enterprise, established in the district of Hooghly, West Bengal, India. In this Organization, maximum workers are low educated and get wage base remuneration. Capital investment capability level is low. Most of the days of a month, the workers cannot work and do not get their wages due to unavailability of required raw materials. The company get adequate order but they cannot achieve customer expectation due to lack of inventory control technique.

V. METHODOLOGY

At first, the Manufacturing Enterprises have been observed periodically. Thereafter, production system of the enterprise is observed properly. The previous documents of production system are observed. Interaction with the skill workers and hierarchy of the unit is also done.

VI.CONCLUSION AND FUTURE WORK

Small Manufacturing Enterprises run with small quantity of resources and less skilled managerial function. At a time, SMEs are required a flexible manner and required to be more reactive to the change of competitive market. In most of the SMEs, due to absent of inventory control technique, production is not at satisfactory level. As a result, SMEs deviate from it setting plan. Now, Small Manufacturing Enterprises are important agent of development for communicators. Therefore, Production planning control is very essential tool in the manufacturing system of SMEs.

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ADVANCED WELDING TECHNIQUE

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Work shop Instructor

There are few welding techniques in which material coalescence at the faying surfaces does take place in the solid state itself contrary to the molten state in most of the conventional welding methods. Thus, a conventional heating source is not required in such techniques. Few popular solid state techniques are briefly presented in the following sections.

Ultrasonic Welding (USW):

Ultrasonic welding (USW) is a solid state process in which coalescence is produced by the localized application of high frequency (10,000-20,000 Hz) shear vibrations to surfaces that are held together under a rather light normal pressure. Although there is some increase in temperature at the faying surfaces, they generally do not exceed one-half of the melting point(s) of the material(s). Instead, it appears that the rapid reversals of stress along the contact interface facilitates the coalescence by breaking up and dispersing the oxide films and surface contaminants, allowing clean material to form a high strength bond.

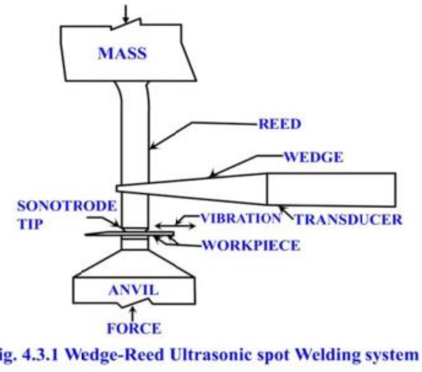


Fig. 4.3.1 Wedge-Reed Ultrasonic spot Welding system

Figure 4.3.1 illustrates the basic components of the ultrasonic welding process. The ultrasonic transducer is essentially the same as that employed in ultrasonic machining, depicted schematically in the Fig. 4.3.1. It is coupled to a force-sensitive system that contains a welding tip on one end. The pieces to be welded are placed between this tip and a reflecting anvil, thereby concentrating the vibratory energy. Either stationery tips (for spot welds) or rotating discs (for seam welds) can be employed.

Ultrasonic Spot Welding:

The individual welds are produced by momentary introduction of vibratory energy into the work pieces as they are held together under pressure between the sonotrode tip and the anvil face. The tip vibrates in a plane essentially parallel to the plane of the weld interface, perpendicular to the axis of the static force application. Spot welds between sheets are roughly elliptical in shape at the interface. They can be overlapped to produce an essentially continuous weldjoint.

Continuous Seam Welding:

In a continuous seam welding, joints are produced between work pieces that are passed between a rotating, disk shaped sonotrode tip and a roller type or flat anvil. The tip may traverse the work while it is supported on a fixed anvil, or the work may be moved between the tip and a counter-rotating or transverse anvil.

work pieces as they are held together under pressure between the sonotrode tip and the anvil face. The tip vibrates in a plane essentially parallel to the plane of the weld interface, perpendicular to the axis of the static force application. Spot welds between sheets are roughly elliptical in shape at the interface. They can be overlapped to produce an essentially continuous weldjoint.

Applications:

Weld ability of different material through USW is presented in Table 4.3.1. Typical applications include:

Table 4.3.1 Weldability in Ultrasonic Welding.

METAL	Al	Cu	Ge	Au	Mo	Ni	Pt	Si	Steel	Zr
Al	•	•	•	•	•	•	•	•	•	•
Cu		•		•		•	•		•	•
Ge			•	•		•	•	•		
Au						•	•	•		
Mo					•	•			•	•
Ni						•	•		•	•
Pt							•		•	
Si										
Steel									•	•
Zr										•

- Joining dissimilar metals in bimetallicplates,
- Microcircuit electricalcontacts,
- Welding refractory or reactivemetals,
- Bonding ultra-thin metalsetc.

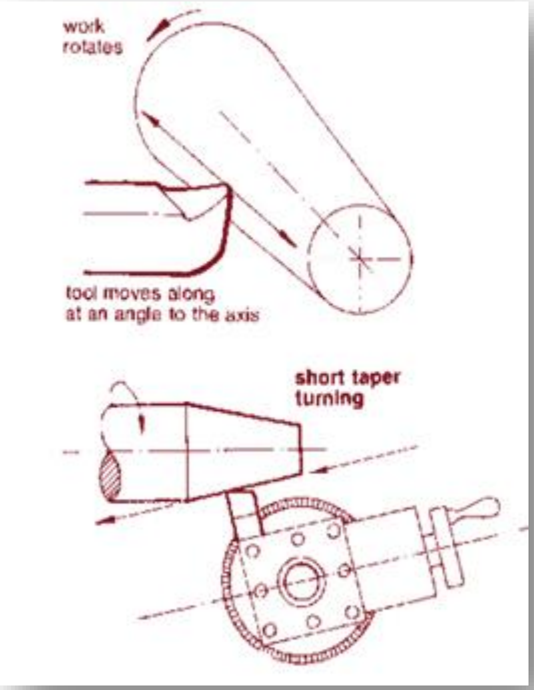
LATHE OPERATIONS

Tarak Kundu
Work shop Instructor

Taper turning.

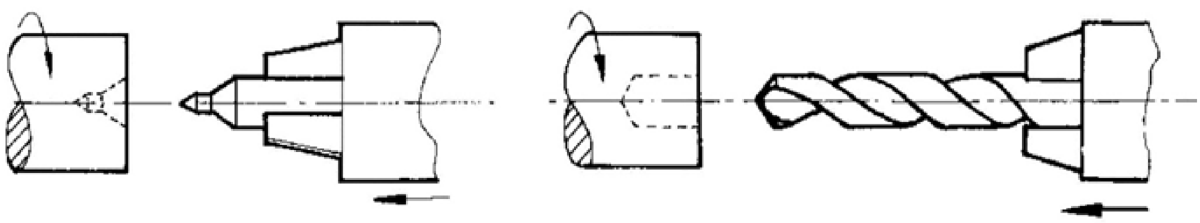
When the tool moves along the work, at in angle to the axis of rotation, a conical shape is produced.

- To turn a very short chamfer uses a formtool.
- Toturnashorttaperrotatethecompoundslidetotherequiredangle, tighten the clamping screws, and move the tool with the compound slide handle. The maximum length of taper which can be turned is limited to the length of feed on theslide.
- To turn a long gradual taper offset the tailstock or use a taper turningattachment.Theworkmustbemountedbetweencentersfor this.



Drilling in the lathe.

This is more accurate than drilling on a drilling machine. Because it is not possible to centre punch work held in the lathe before drilling, we use a centre drill instead

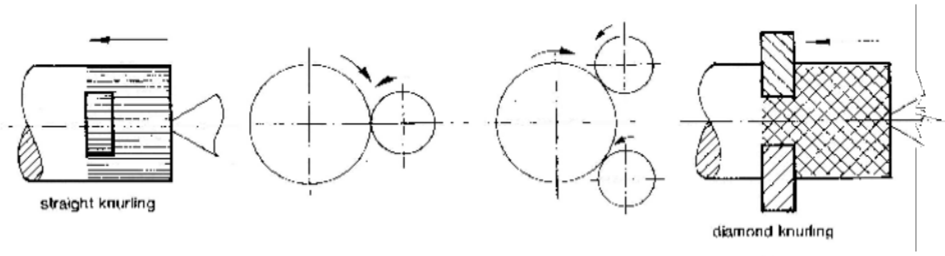


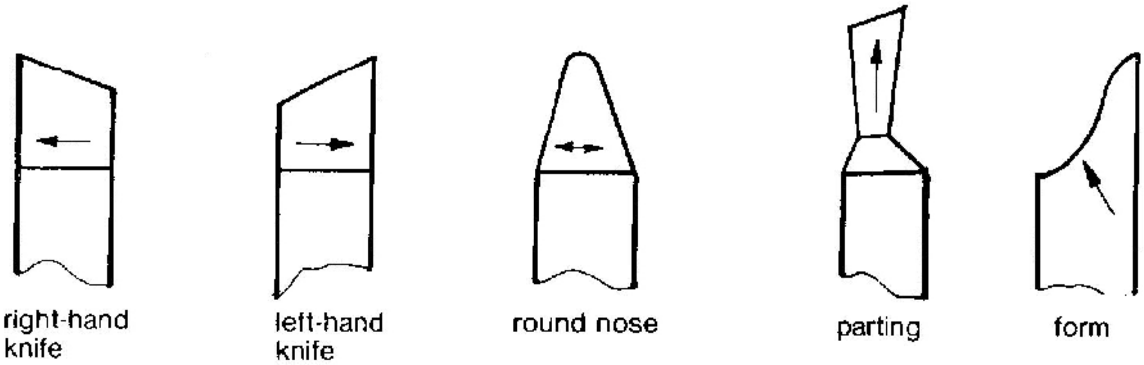
Knurling

Knurlingtoolsareusedtopress(notcut)adiamondorstraightpatternoflinesintometal,usuallytoprovidea grip. Two very hard steel wheels mounted in a swiveling head are needed to make a diamond knurl, but only asinglewheelforstraightknurling.Fine,medium,andcoarseknurlingtoolsareavailable.Oilshouldbeused to lubricate the wheels when knurlingsteel.

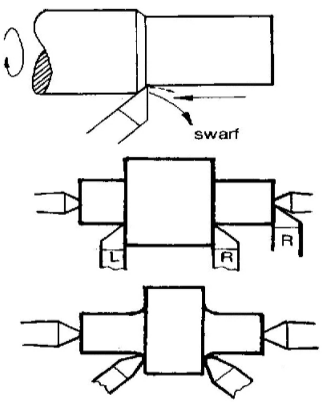
Feedthetoolintotheworkandadjustituntiltheimpressionmadebythewheelsisequalandevenfromleftto right.Thenincreasethepressureuntilafullknurledprintisbeingmadeon themetal,andslowlymovethetool along the work.

Lathe too





Round nosed tools give a smoother finish than pointed tools, but larger cuts can be taken with a pointed tool. A knife tool is necessary to turn to a sharp shoulder, and can be used to take roughing cuts. It must have a slight radius at its tip, produced by using a slip stone, to prevent the extreme tip from burning or breaking off and to improve finish. When roughing with a knife tool set it to give the correct approach angle as shown, with the tool angle trailing, so that swarf is directed away from the work, and so that it will swing safely out of the way without digging into the material if the tool comes loose.



Right-hand knife tools can be used to face off the right-hand end of a bar, to cut to a right-handed shoulder, or to cut along the work from right to left.

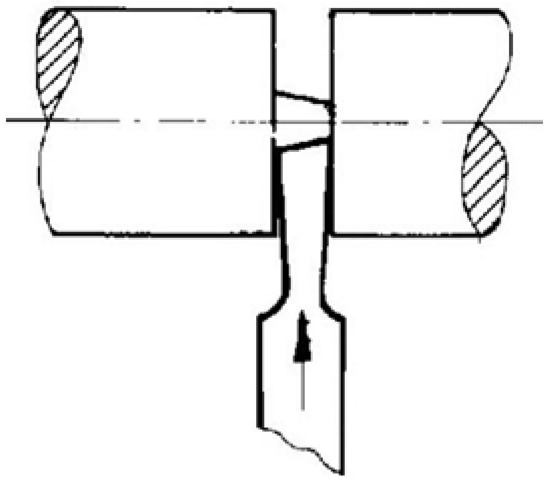
Left-hand knife tools can be used to cut to a left-handed shoulder or cut along the work from left to right.

Round nosed tools can be used to cut in either direction and to cut to left- or right-handed shoulders where a radius corner iswanted.

Form tools can be specially ground to produce any required shape, such as the curved top of a turned screw- driver handle.

Parting-off

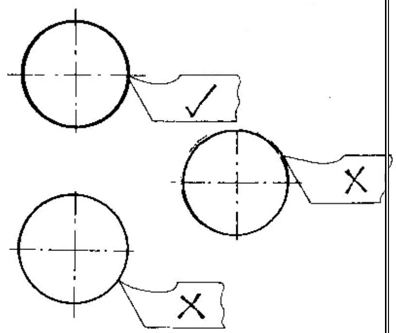
A narrow tool is fed into the work, exactly square to the axis, to cut it to the correct length and face it off at the same time.



The tool is offset to the left so that you can part off as close to thechuck as possible. The sides of the tool taper 1° or 2° from the cutting edge to the back to prevent the tool jamming in the groove. The sides also taper 2° from top to bottom and the tool has a front clearance of about5°.

The top rake is 5° for steel and aluminum, flat for cast iron and 2° negative for brass. The cutting edge slopes so that the work- piece is cut off cleanly, and the pip remains on the spare material where it is faced off.

Setting up lathe tools



The correct height for general purposes is to set the tool at centre height asshown.

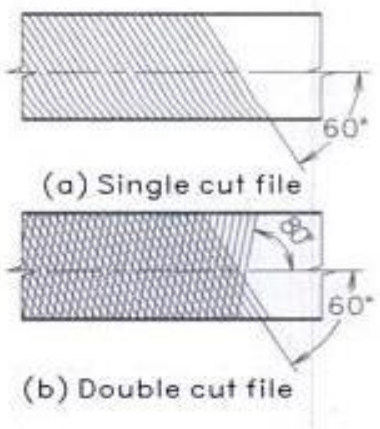
Always support the tool in the tool post, as near to the cutting edge as possible. A large overhang increases the risk of vibration or chatter, causing poor finish, inaccurate work and the risk of tool breakage. A tool which is set too *high* will simply rub against the work without cutting. A tool which is set too *low* will dig into the work and try to go underneath it. This may bend the work or break the tool.

FITTING OPERARTIONS

Tarun Chakraborty
Work shop Instructor

Files

Files are multi points cutting tools. It is used to remove the material by rubbing it on the metals. Files are available in a number of sizes,shapes and degree of coarseness.



Classification of files

i. On the basis of length

4",6",8",12"

ii. On the basis of grade:

- Rough (R)(20 teeth per inch)
- Bastard (B)(30 teeth per inch)

- Second cut (Sc) (40 teeth per inch)
- Smooth file (S)(50 teeth per inch)
- Dead smooth (DS)(100 teeth per inch)

Rough and bastard files are the big cut files. When the material removal is more, these files are used. These files have bigger cut but the surface produced is rough.Dead smooth and smooth files have smaller teeth and used for finishing work. Second cut file hasdegree of finish in between bastard and smooth file.

iv. On the basis of number of cuts:

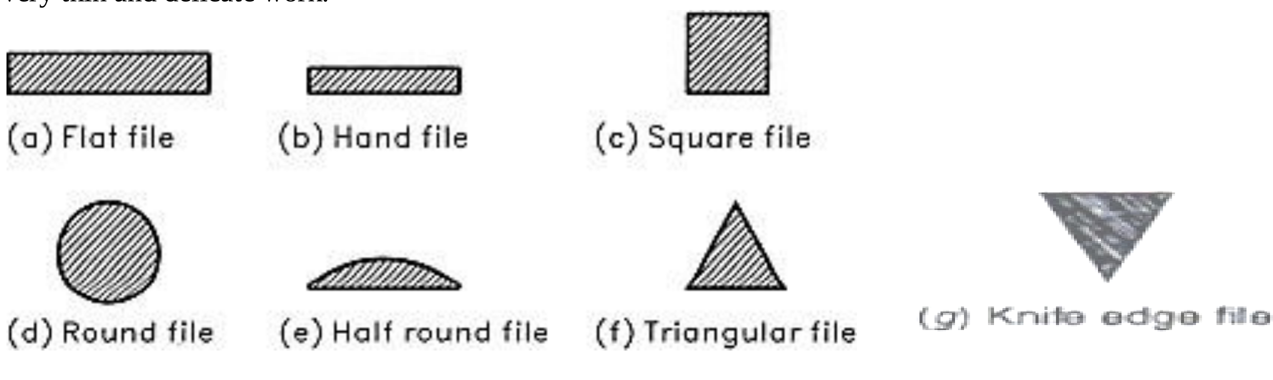
- Single cut files.
- Double cut files.

In single cut files the teeth are cut in parallel rows at an angle of 60 degree to the face. Another row ofteeth is added in opposite direction in case of double cut files. Material removal is more in case ofdouble cut files.

iii. On the basis of shape and size:

The length of the files varies from 4' to 14*. The various shapes of cross-section available are handfile, flat file, triangular, round; square, half round, knife-edge, pillar, needle and mill file.

a. **Flat file:** This file has parallel edges for about two-thirds of the length and then it tapers in width and thickness. The faces are double cut while the edges are single cut.
b. **Hand file:** for a hand file the width is constant throughout, but the thickness tapers as given in flat file. Both faces are double cut and one edge is single cut. The remaining edge is kept uncut in order to use for filing a right-angled corner on one side only.
c. **Square file:** It has a square cross-section. It is parallel for two-thirds of its length and then tapers towards the tip. It is double cut on all sides. It is used for filing square corners and slots.
d. **Triangular file:** It has width either parallel throughout or up-to middle and then tapered towards the tip. Its section is triangular (equilateral) and the three faces are double cut and the edges single cut. It is used for filing square shoulders or comers and for sharpening wood working saws.
e. **Round file:** It has round cross-section. It carries single cut teeth all round its surface. It is normally made tapered towards the tip and is frequently known as rat-tail file. Parallel round file having same diameter throughout the length are also available. The round files are used for opening out holes, producing round comers, round-ended slots etc.
f. **Half-round file:** Its cross-section is not a true half circle but is only about one-third of a circle.
The width of the file is either parallel throughout or up-to middle and then tapered towards the tip.
The flat side of this file is always a double cut and curved side has single cut. It is used for filing curved surfaces.
g. **Knife edge file:** It has a width tapered like a knife blade and it is also tapered towards the tip and thickness. It carries double cut teeth on the two broad faces and single cut teeth on the edge. It is used for finishing sharp corners of grooves and slots
h. **Diamond file:** Its cross-section is like a diamond. It is used for special work.
i. **Needle file:** These are thin small files having a parallel tang and a thin, narrow and pointed blade made in different shapes of its cross-section to suit the particular need of the work. These are available in sizes from 100 mm to 200 mm of various shapes and cuts. These files are used for filing very thin and delicate work.



Methods of filing

The following are the two commonly used methods of filing:

1. Cross-filing 2. Draw filing. 3. Straight filing

Cross-filing. Refer Fig. (a).

This method is used for efficient removal of maximum amount of metal in the shortest possible time. It may be noted that the file must remain horizontal throughout the stroke (long, slow and steady) with pressure only applied on the forward motion.

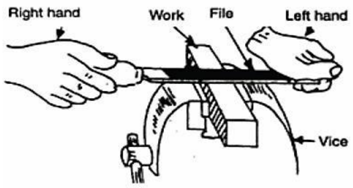
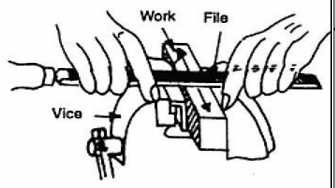


Fig-a Cross filing

Draw filing. Refer Fig. (b)

This method is used to remove file marks and for finishing operations. Here, the file is gripped as close to the work as possible between two hands. In this filing method, a fine cut file with a flat face should be used.



(b) Draw filing