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Wood

Summary

Overview and Classification

WOOD STRUCTURE

- Macrostructure of wood:
- Wood Microstructure:

Physical Properties:

Traditional Wood Products:

The different materials, elements, and constructions in wood are

Positive properties of wood:

Defects of wood

The defects of wood

Wood defects caused by plant pests

Wood protection against alterations caused by fungi and insects

Wood

Traditional Wood Products:

Traditional wood products encompass a wide range of items made from this natural material for millennia. Here's an explanation of some of these products:

Furniture: Wood is widely used in furniture making for its durability, beauty, and versatility. From chairs and tables to cabinets and beds, wood is a material of choice for a wide variety of furniture.

Tools: Many traditional tools are made of wood due to its sturdiness and ability to be shaped into various forms. Tool handles such as hammers, axes, and chisels are often made of wood.

Wood

Traditional Wood Products:

Timber Framing: Wood has long been used in timber framing to support the structures of buildings. Wooden beams provide structural strength and flexibility, making them a popular choice for timber framing.

Musical Instruments: Many musical instruments are made of wood due to its unique acoustic properties. From guitars and violins to flutes and pianos, wood plays an essential role in creating harmonious sounds.

Sculptures: Sculptors often use wood as a preferred material to create beautiful and expressive works of art. Its ability to be sculpted and shaped makes it an ideal medium for expressing artistic creativity.

Wood

Traditional Wood Products:

Decorative Objects: Decorative items such as bowls, trays, photo frames, and decorative sculptures are made of wood to add a touch of natural warmth and beauty to a space.

Ships and Boats: Before the era of modern materials, wood was the primary material used in shipbuilding. From fishing boats to majestic sailboats, wood was used to create vessels capable of navigating the oceans.

Wood

Assemblages:

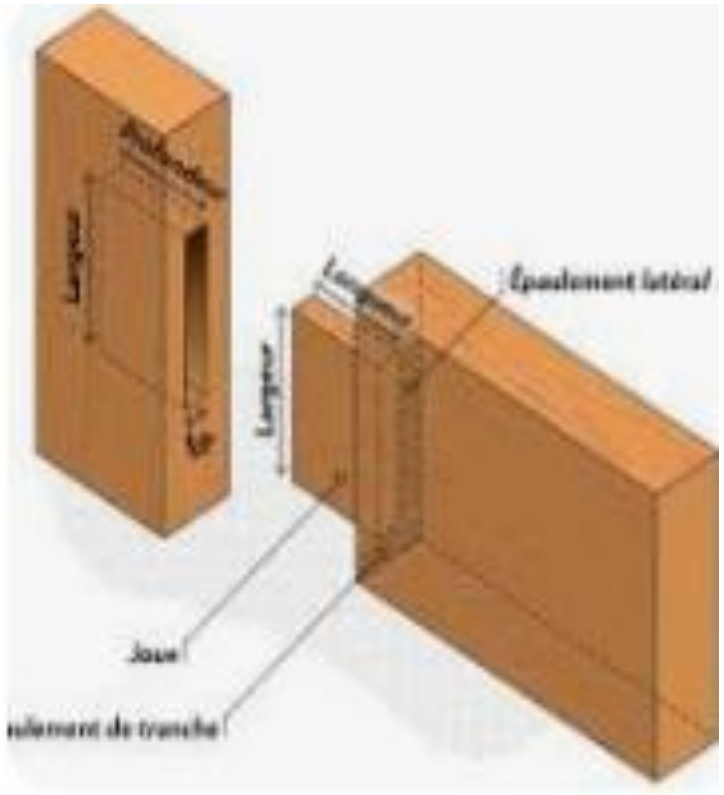
In furniture making, wooden structures, and other products, various assembly techniques are used to join wooden pieces together in a strong and durable manner. Some commonly used assembly techniques include:

- 1- **Mortise and tenon:** A traditional method where a portion of one piece of wood is shaped into a projecting member (tenon) that fits into a corresponding slot (mortise) in another piece. The mortise and tenon joint is a traditional and widely used method in woodworking. Here's a more detailed explanation of this technique:

Wood

Assemblages:

- 1-**Mortise and tenon:**



Wood

Assemblages:

- **Tenon:** A tenon is a rectangular or square projection carved at the end of a piece of wood. It is usually sized to fit snugly into a corresponding mortise in another piece of wood. The tenon is often narrower than the main wood piece to allow for a precise fit into the mortise.
- **Mortise:** A mortise is a notch or opening carved into a piece of wood to receive the tenon. It is typically chiseled out using a wood chisel, a mortising saw, or other specialized tools. The mortise is designed to perfectly match the tenon to form a tight and strong joint.
- **Assembly**: To assemble two pieces of wood using the mortise and tenon method, the tenon is inserted into the mortise. Then, the tenon can be glued into the mortise to reinforce the joint. In some cases, wooden dowels may also be used to lock the tenon in place.

Wood

Assemblages:

- **Advantages:** This assembly method offers several advantages, including:
- **Strength:** Mortise and tenon joints are known for their strength and durability, making them suitable for applications where strong adhesion is required.
- **Aesthetics:** Mortise and tenon joints often provide an attractive aesthetic, especially when the tenons are visible on the surface of the assembled piece.
- **Longevity:** Due to their strength, mortise and tenon joints are generally durable and can withstand the test of time.
- **Applications:** This technique is widely used in furniture making, timber framing, fine woodworking, and other woodworking projects where strong and aesthetic joints are required.

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Wood

Assemblages:

- **2-Dovetail:** Dovetail joints are cut into two pieces of wood that interlock to form a strong joint.

Dovetail joinery, also known as dovetailing, is a traditional woodworking technique used to create strong and aesthetic joints. Here's a detailed explanation of this method:

- **Dovetails:** Dovetails are triangular-shaped cuts, often resembling the tail of a dove or a beaver's tail, cut at the end of the pieces of wood to be joined. There are different types of dovetails, including straight dovetails and dovetails with tapered tails, each with its own characteristics and uses.

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Wood

Assemblages:

- **2-Dovetail:**
- **Assembly:** To assemble two pieces of wood using dovetails, tails are cut at the end of one piece (the tail), and corresponding notches (the pins) are cut into the other piece. When the two pieces are assembled, the tails interlock with the pins, creating a strong and durable joint. This configuration creates a larger contact surface between the two pieces, thus reinforcing the joint.
- **Advantages:** • **Strength:** Dovetail joints offer great strength and are known for their durability. They are often used in the construction of drawers, boxes, and other furniture requiring robust joints.

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Wood

Assemblages:

- **2-Dovetail:**
- **Advantages:**

• **Aesthetic:** Dovetails are appreciated for their attractive appearance. When properly cut, they add an aesthetic touch to the assembled piece and can be used as a decorative element. • **Self-locking:** Due to their specific shape, dovetails tend to tighten further when pressure is applied in the direction of the assembly, thereby strengthening the joint.

Applications: This technique is commonly used in furniture making, especially for assembling drawers, boxes, and high-quality frames. It is also used in fine woodworking and other projects where strong and aesthetic joints are needed.

Wood

Assemblages:

- **2-Dovetail:**

Wood

Assemblages:

- **3-Biscuit joint:**

Wooden or plastic biscuits are inserted into grooves cut into the pieces of wood to be joined, reinforcing the glued joint.

The biscuit joint is a commonly used assembly method in woodworking to strengthen glued joints between two pieces of wood. Here's how this technique works:

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Wood

Assemblages:

- **3-Biscuit joint:**

Biscuits:

Biscuits are small rectangular pieces made of wood or plastic, often from beech or maple. They are inserted into grooves cut into the pieces of wood to be joined. These grooves are typically cut using a router equipped with a biscuit cutter specifically designed for this purpose.

Assembly:

To assemble two pieces of wood using biscuits, grooves are cut into the joining faces of both pieces. The biscuits are then inserted into these grooves. When glue is applied to the contact surfaces of the wood pieces, the biscuits swell slightly as they absorb the glue. This creates a stronger bond between the two pieces, reinforcing the joint.

Wood

Assemblages:

- **3-Biscuit joint:**

Advantages:

Reinforcement of the joint: Biscuits add surface contact between the two pieces of wood, strengthening the glued joint. **Alignment:** Biscuits can also help align the wood pieces during assembly, which is particularly useful for larger pieces. **Ease of use:** The biscuit joint is relatively easy to make and requires only basic woodworking skills and simple tools such as a router equipped with a biscuit guide.

Applications:

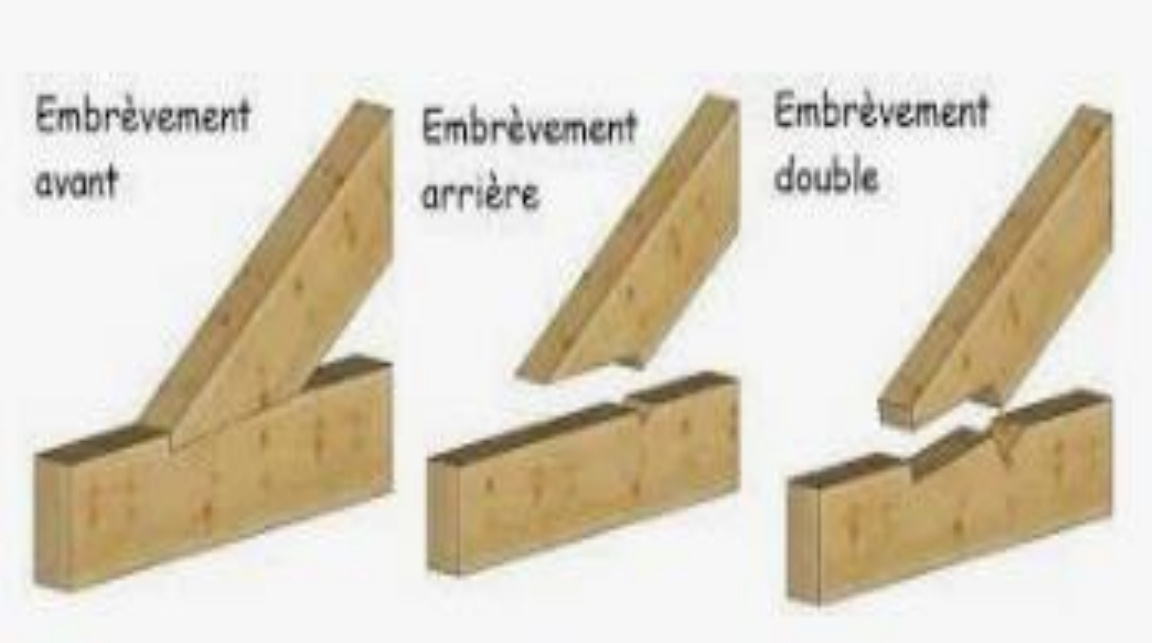
This technique is often used in furniture making, especially for assembling wood panels to form tabletops, cabinets, and other furniture elements. It is also used in other woodworking projects where strong and durable glued joints are needed.

Wood

Assemblages:

- **4-Half-lap joint:**

Wood pieces are cut in such a way that the ends of each piece interlock together.



Wood

Assemblages:

4-Half-lap joint: Half-lap joint is a traditional and robust method for joining two wood pieces by interlocking them together at their ends. Here's how this technique works:

- **Principle:** In a half-lap joint, each wood piece is cut in a way that rectangular sections are removed from their ends. When these pieces are then assembled, these removed sections interlock with each other, creating a solid and stable joint.
- **Manufacturing:** To create a half-lap joint, typical steps include:

Measurement and marking: Wood pieces are accurately measured, and the locations of the cuts to be made are marked on each piece.

Wood

Assemblages:

4-Half-lap joint:

Cutting: Rectangular sections are cut from the ends of the wood pieces, typically using a table saw, radial saw, or hand saw, depending on the size and complexity of the pieces.

Fitting: The pieces are carefully fitted to ensure that the cuts interlock perfectly with each other.

Assembly: Once the pieces interlock correctly, glue can be applied to the contact surfaces to reinforce the joint. Wooden dowels can also be used to further secure the assembly.

Wood

The different materials, elements, and constructions in wood are:

Round wood materials (logs): Used in the construction of various structures, including load-bearing elements of houses and bridge decks. Their moisture content and quality must be controlled, and they must be stored properly to prevent deterioration.

Sawn timber: Produced by longitudinal sawing of wood, it includes planks, battens, and joists used in various construction applications. Specifications are provided for dimensions and allowable moisture content.

Wood blanks: These sawings conform to the dimensions required for further machining. They are classified based on their thickness and machining.

Wood

The different materials, elements, and constructions in wood are:

Flooring materials: Include materials such as parquet, floorboards, and wooden pavers, with specifications on the types of wood used and allowable moisture levels.

Plywood and roofing materials: Different types of plywood are described, as well as roofing materials such as chips, shingles, and wooden panels, with specifications on their dimensions and uses.

Joinery elements: Includes the elements necessary for doors, windows, partitions, etc., with details on the materials used and manufacturing methods.

Wooden construction elements: Describes prefabricated wooden construction elements for different types of houses and structures, with specifications on materials and construction methods.

Reception, transportation, and storage: Guidelines are provided for inspecting the quality of materials, protecting them during transportation, and properly storing them on-site.

Wood

Positive properties of wood:

Relatively high mechanical strength: Wood offers good resistance to loads and can be effectively used in the construction of structures.

Moderate density: Wood has a relatively low density compared to its strength, making it an attractive construction material for many applications.

Low thermal conductivity: Wood has relatively low thermal conductivity, making it efficient for thermal insulation in construction.

Ease of machining: Wood is easy to work with, allowing for efficient handling and processing during construction.

Wood

Defects of wood:

Anisotropy: Wood exhibits variation in mechanical and thermal properties depending on the direction of the fibers, which can lead to inconsistencies in its behavior in certain situations.

Hygroscopicity: Wood readily absorbs and releases moisture from the air, leading to dimensional changes and alterations in its properties over time.

Susceptibility to rot and ignition: Wood is prone to biological decay (rot) and can easily catch fire when exposed to heat sources or fire.

Wood

The defects of wood

Wood defects are abnormalities in its normal structure or alterations affecting its technical properties, which may occur during its growth, storage, or utilization. These defects are classified into several categories based on their causes: structural anomalies, mechanical damage, alterations by fungi, and defects caused by insects.

Structural anomalies include twisted grain, characterized by obliquely oriented fibers, which decreases the strength of the wood. Compression wood is also observed in softwoods, as well as trunk curvatures and constrictions, reducing the yield of finished products. The presence of two piths in the cross-section of the trunk is called double pith, which decreases the quality of the assortment. Knots, varying in size and appearance, can be sound or defective, with some being sites of decay. Cracks, such as checks and shakes, may form during drying or due to various environmental causes. Checking can be simple or cross, depending on the arrangement of the fissures on the wood's cross-section.

Wood

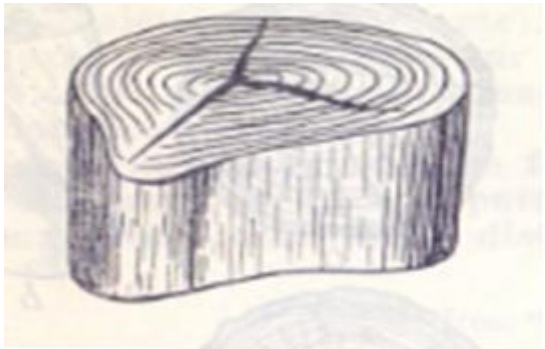
Wood defects caused by plant pests:

mainly fungi, are diverse. They include abnormal color alterations and rot, resulting from the action of fungi feeding on wood cells. Fungi thrive in conditions of oxygen, water, and favorable temperature. Wood with less than 20% moisture, as well as that submerged or exposed to freezing, is less susceptible to decay. Some fungi specifically affect living trees, others only cut wood, while some attack both. Their impact varies: some simply change the wood's color, while others deteriorate and rot it.

Examples of destructive fungi include white or brown rot, as well as white rot in hardwoods, which continue to degrade the wood even after its conversion into construction material. House fungi, such as dry rot, can also cause significant damage. When wood is dry, the decay process ceases, and all fungi die. Insects, like wood borers, can also cause defects, such as woodworm, especially in freshly felled or dried wood. Bark beetle damage, caused by wood borers and other insects, is a superficial defect that can spread if the affected wood is used without proper treatment.

Wood

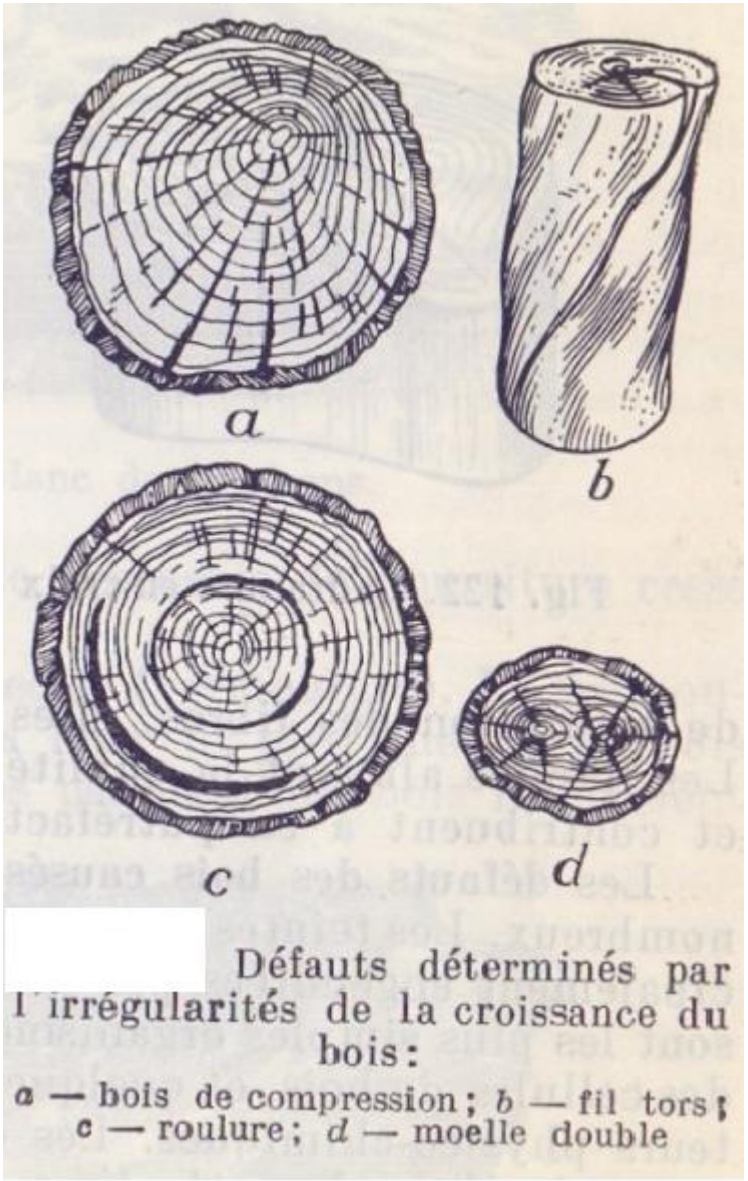
Wood defect



Cadranure en croix

Fente de retrait

Champignon blanc des maisons



Défauts déterminés par l'irrégularités de la croissance du bois:

a — bois de compression ; *b* — fil tors ; *c* — roulure ; *d* — moelle double

Wood

Wood protection against alterations caused by fungi and insects

Wood protection against alterations caused by fungi and insects is crucial, whether it is for wood used in construction or stored in a warehouse. Different wood species have varying resistances to these attacks. Dense woods rich in summerwood and tannic substances are generally more resistant, while debarked wood can be stored in dry and well-ventilated premises for an extended period.

To increase the durability of wood, several methods are used, including avoiding its exposure to moisture through structural measures, painting or coating, as well as drying and impregnating it with antiseptic agents.

Wood

Painting, coating, and drying help extend the lifespan of wood by protecting it from the elements. Applying oil-based paints, varnishes, or linseed oil forms a protective barrier on the wood surface. Coating with dry tar can also be effective. Drying wood in cold water or during floating removes plant saps and reduces the risk of rot.

Antiseptics are substances toxic to fungi responsible for wood decay. They are classified based on their solubility in water, oily nature, or in paste form. Water-soluble antiseptics, such as sodium fluoride and sodium fluosilicate, are used to treat wood that will not be exposed to water. Oily antiseptics, like tar oil, are used to protect wood exposed to air, soil, or water. Antiseptic pastes, composed of different ingredients such as sodium fluoride and peat powder, are used to cover elements exposed to moisture and weathering.

Wood treatment methods with antiseptics include several approaches such as surface treatment, impregnation in hot-cold baths or high-temperature baths, as well as pressure soaking.

Wood

Surface treatment: This method involves coating or spraying wood with an antiseptic solution to protect its surface.

Impregnation in hot-cold baths: Wood is immersed in a bath containing a hot antiseptic (98 °C) for several hours, then transferred to a cold antiseptic bath (15-20 °C for water-soluble antiseptics and 40-60 °C for oily antiseptics) for some time. This method is effective for slightly dried wood with sapwood moisture below 30%.

Impregnation in high-temperature baths: Used for treating green wood, this method involves immersing the wood in a bath of melted liquid petrolatum (120-140 °C) for heating and drying, followed by a bath of oily antiseptic at a temperature of 65-75 °C for 24 to 48 hours.

Wood

Pressure soaking: Wood is placed in cylindrical steel boilers under pressure (0.6-0.8 MPa) with aqueous or oily antiseptics. After impregnation, the pressure is reduced, and the antiseptics are drained.

Additionally, to protect wood against inflammation, it is possible to cover it with coatings or fire-resistant materials such as plaster or asbestos cement sheets. Fire-resistant paints are also used, classified into different categories such as silicate, casein, oil, and vinyl chloride paints, providing fire protection by forming a fireproof layer on the wood. Furthermore, impregnation with flame retardants, special chemicals, is an effective method to reduce the flammability of wood in the presence of high temperatures.