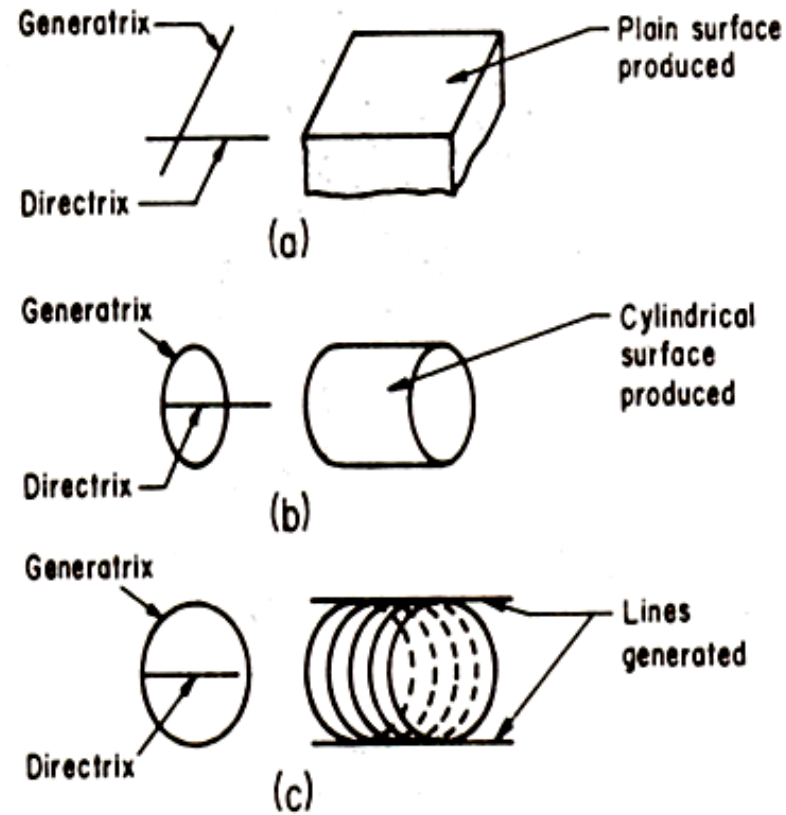


Module: Machine-tools

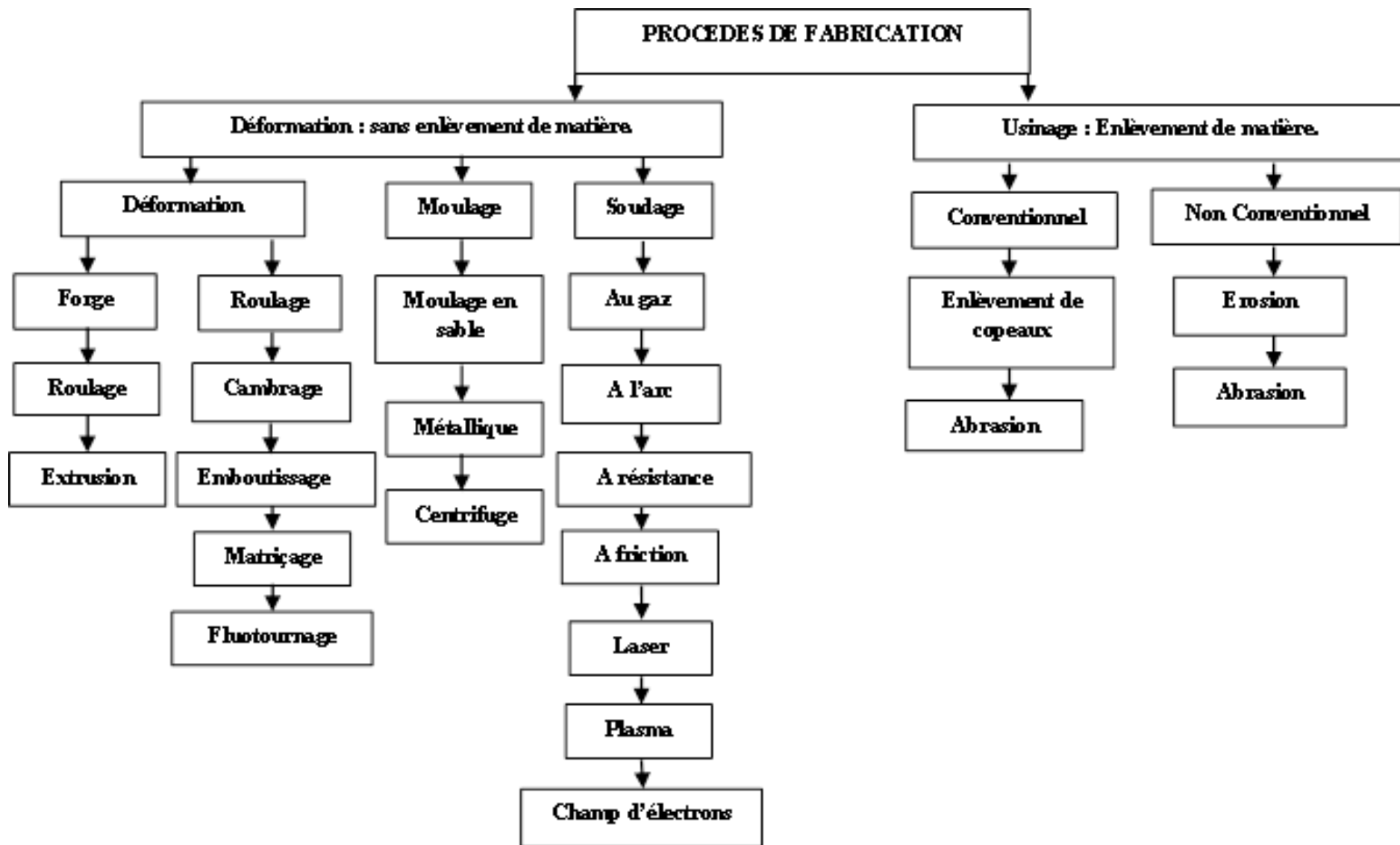
Speciality: M1 manufacturing and Production

General information on machine tools

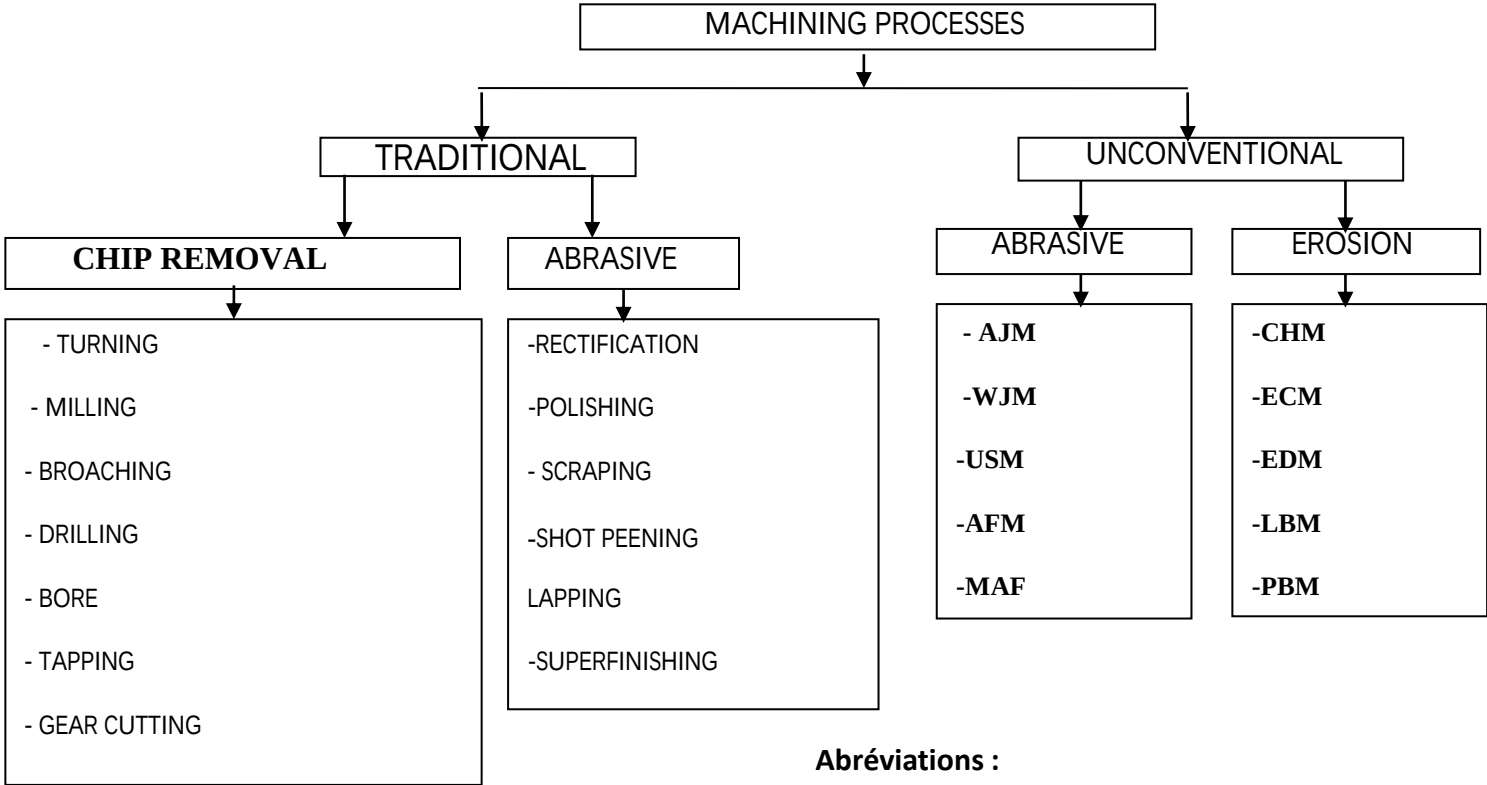
I-1- Production of shapes in machining :



I-2- Classification of manufacturing processes:



I-3- Machining processes categorization :



Abréviations :

- **AJM** abrasive jet machining: Usinage par jet abrasif
- **WJM**, water jet machining : Usinage par jet d'eau
- **USM**, ultrasonic machining : Usinage par ultrasons
- **AFM**, abrasive flow machining : Usinage par écoulement abrasif
- **MAF**, magnetic abrasive finishing : Finition abrasive magnétique
- **CHM**, chemical machining : Usinage chimique
- **ECM**, electrochemical machining : Usinage électrochimique.
- **EDM**, electrodischarge machining : Usinage par électro-décharge
- **LBM**, laser beam machining : Usinage par faisceau laser
- **PBM**, plasma beam machining : Usinage par faisceau de plasma.

Definition of chip removal machining:

Chip removal machining is one of the processes used to shape, obtain precise parts from cast, extruded or forged raw parts. The removal requires the conjunction of two relative movements part/tool:

- Cutting movement (M_c): produced by specific organs (Gearbox: B_v)
- Feed movement (M_f): produced by specific organs (Gearbox : B_a)

these movements are communicated to the moving parts (tables, trolleys) that move in relation to the fixed parts of the machine (the base or frame).

Machine tool definitions:

Machine tools are stationary machines, intended to physically perform the cutting movements (M_c) and (M_a), necessary to obtain a surface by removing material. They are driven by motors and used to shape metal or non-metallic parts, using cutting tools or abrasive grains.

Structure of a machine tool:

- Spindle: system producing the M_c (tool or part rotation)
- Trolleys or (machine axes): systems for positioning the tool in relation to the part;
- Control and measurement system: allowing the monitoring of the machining process on the machine and the positioning of tools and parts on the machine;
- Frame: mechanical element that ensures the link between these systems.

Machine tool components

1-Power source : electric motor or hydraulic motor.

2-The frame: rigid and limits deformations due to heat, it has 2 functions:

Basic functions:

- Guidance of motion axes,
- Arrangement of machine components to ensure correct geometry,
- Supports mechanical action and vibration,

Auxiliary functions:

- Chip management,
- Operator protection
- Dissipation of the heat.

3- Transmission mechanisms: These are sets that ensure the transfer of power from the source to the moving parts; (gearboxes - feed boxes - reversing mechanisms- transformation mechanisms of the nature of the movement).

4-Autonomous blocks: Perform the fundamental machining movements (trolleys - tables - aprons).

5-The travel axes : Animate the moving parts of the machine with strong accelerations. the axes consist of motorization, drive system, and guidance and measurement system. The guide is provided by slides to limit friction, and to support high loads allows precise positioning relative to the reference.

6-Spindle: generates the necessary cutting movement, must be very rigid and thermally stable.

7-Control units and measuring system: The control devices allow to maneuver and locate the position (cranks, levers, pedals and steering wheels). Measuring systems (graduated drums on older models or counters of screw turn numbers and angular position in the most recent versions).

8-Tool holders and plug elements: Ensure the connection between the tool and the machine and support the high dynamic loads generated by machining. plug elements: ensure that the execution elements (part/tool) are kept in position with respect to the spindle and/or frame.

Classification of machine tools:

Ranking criteria: several criteria can be selected:

depending on the destination - depending on the possibilities of carrying out technological operations - according to the control mode.

Classification by destination (degree of universality):

- **General or universal machine tools :**
 - Mixed production machines,
 - Universally used (ie by several industries: the parallel lathe).
 - Equipped with universal devices, universal tools and can machine parts of different shapes and dimensions,
 - intended for unit work or small series.
have a wide range of cutting and feed speeds.
- **Specialized machine tools:**
 - Includes series production machines for parts of specific shapes or similar shapes (semi-automatic lathe).
 - The range of speeds and advances is reduced and their drivetrain is simplified.
- **Special machine tools:**
 - Includes machines for producing a particular part of a single type of parts or a specific technological operation (gear cutting).
 - They are used in mass production or mass production.

Ranking according to the possibilities of carrying out technological operations :

- **Universal machine tool :** machines capable of performing a wide variety of operations.
- **Productive machine tool:** machines capable of performing special operations of limited number but in large series.

Classification according to control mode (degree of automation): machine tools are grouped into three families:

- **Machine tool with manual control:** the realization of machining operations requires the assistance of a worker permanently.
- **Machine tool with semi-automatic control:** the worker is only needed for feeding or unloading machining parts or if there is a stop of the has a fault.
- **Machine tool with automatic control:** Totally autonomous, the intervention of a worker is not necessary that for the start-up, the machine works according to a cycle prepared in advance until exhaustion of the parts store (total autonomy)

Classification by machining precision: Four classes of precision;

- Normal,
- Advanced,
- High,
- Very hig,

Classification of machine tool movements:

1-Fundamental movements (Mc): It is the main movement of chip production, characterized by its high speed compared to other movements. it consumes a large part of the power of the machine.

2-complementary or displacement movements : This and the second production movement. it allows the repetition of the cutting movement in several places to generate surfaces or allows to make a quick approach to the tool or a division

3-Auxiliary movements : Movements assisting in the production of shapes and surfaces such as clamping and orientation of the workpiece or tool.