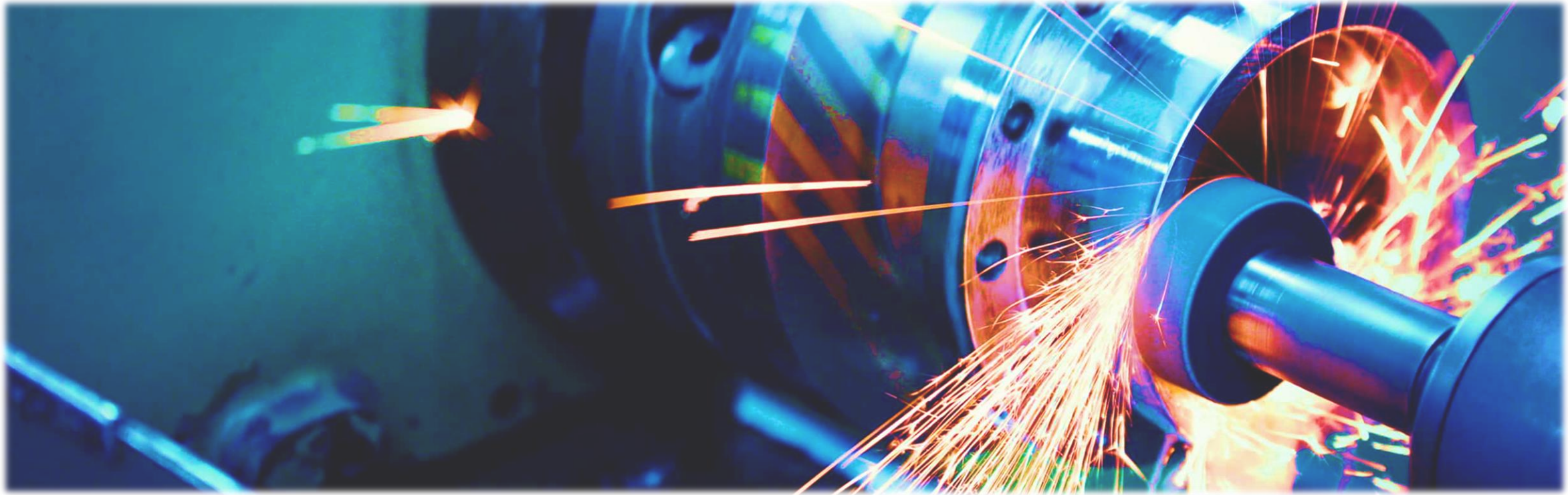
MEC 212 METAL CUTTING PROCESSES

LECTURE NO.1 (Spring 2026) [2nd level Design and Production Engineering]

Dr. Yahya Abdelhameed Amer



LECTURE RULES

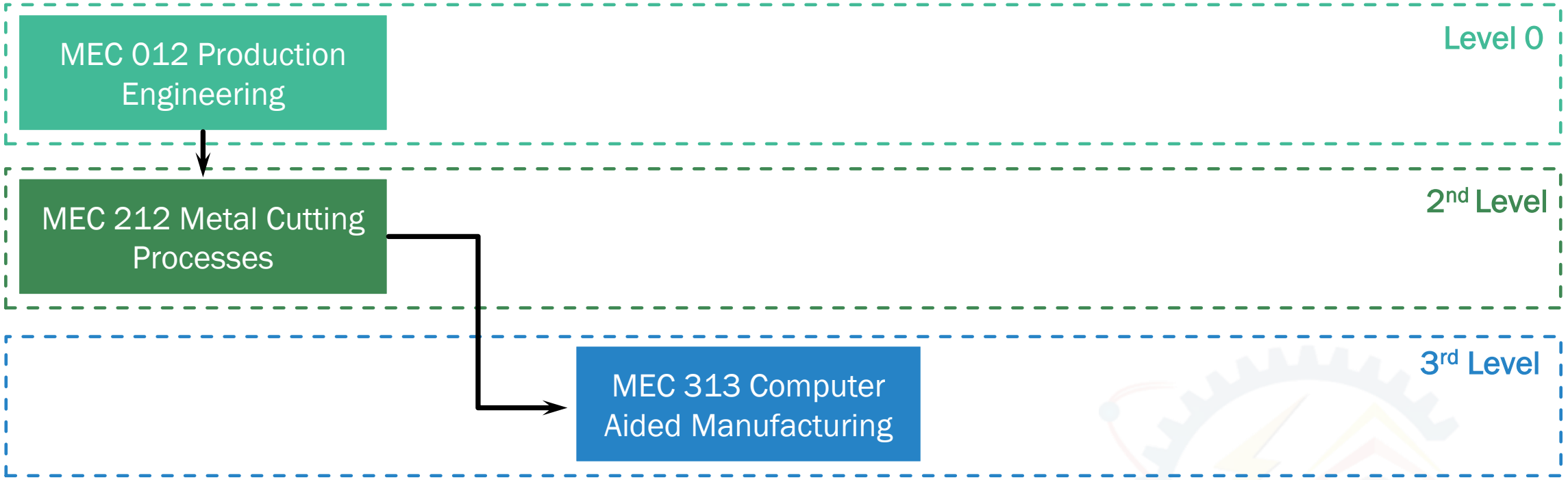
Dream big, stay positive, work hard, and enjoy the journey.

COURSE SPECIFICATIONS

- Course code-title: **MEC 212** - **Metal Cutting Processes**
- **2nd level** in Design and Production Engineering Program
- Course duration: **One semester**
- Course type: **Compulsory**
- **3** Credit Hours **4** contact hours [2 Lecture + 2 Lab]
- Total grades: **100** [10 Student activity, 30 Midterm exam, 20 Practical exam, 40 Final exam]
- Minimum rating for success: **D Rating** [GPA 1.00, 64% > Grades > 60%]
- Course pre-requisite: **MEC 012 Production Engineering**
- Lecture scheduled on **Wednesday** in **B1 Hall**, first floor

COURSE SPECIFICATIONS

- **Course Map:**



COURSE SPECIFICATIONS

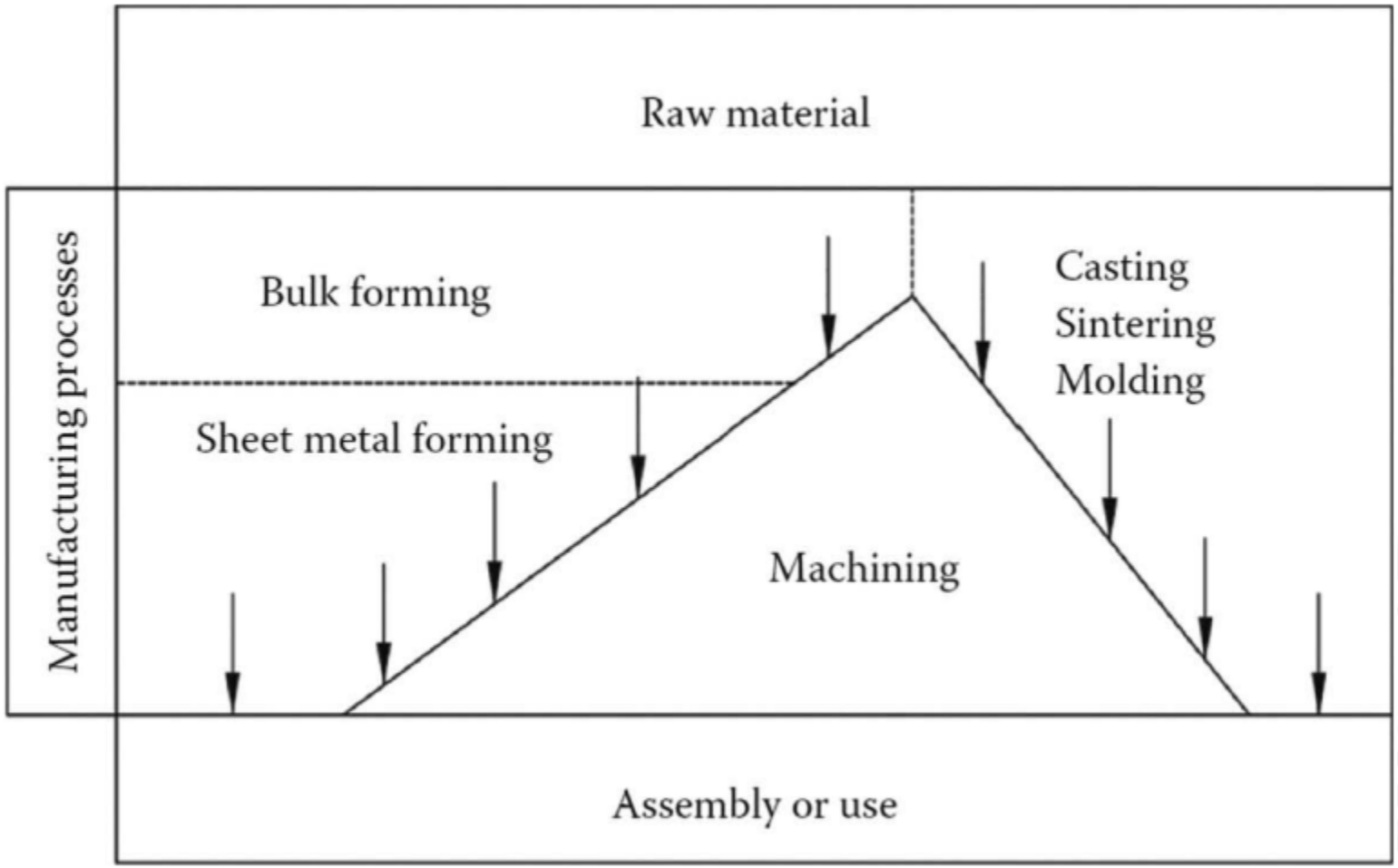
Course Contents:

- Introduction to the theory of metal cutting.
- Tool geometry and tool materials.
- Chip formation.
- Mechanics of metal cutting.
- Thermal aspects of metal cutting.
- Surface quality and dimensional control.
- Mechanics of grinding.

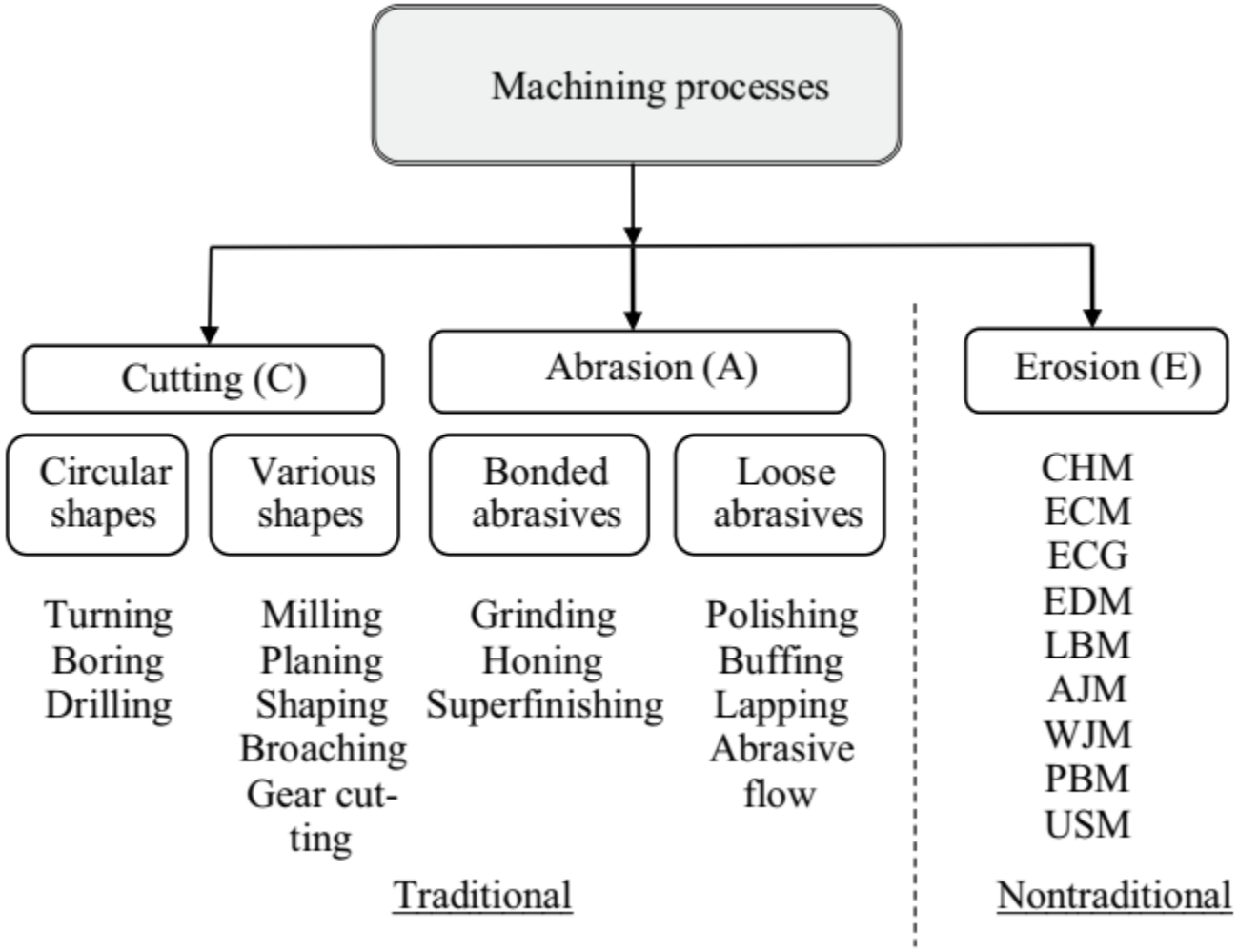
INTRODUCTION TO METAL CUTTING

- Machining is the removal of unwanted materials from the workpiece to obtain a finished product of the desired size, shape, and surface quality.
- Machining is generally used as a final finishing operation for parts produced by casting and forming before they are ready for assembly or use.
- Reasons for using machining are to obtain closer dimensional control and tighter tolerances, special surface quality, external and internal geometric features that cannot be produced by other manufacturing operations.

INTRODUCTION TO METAL CUTTING

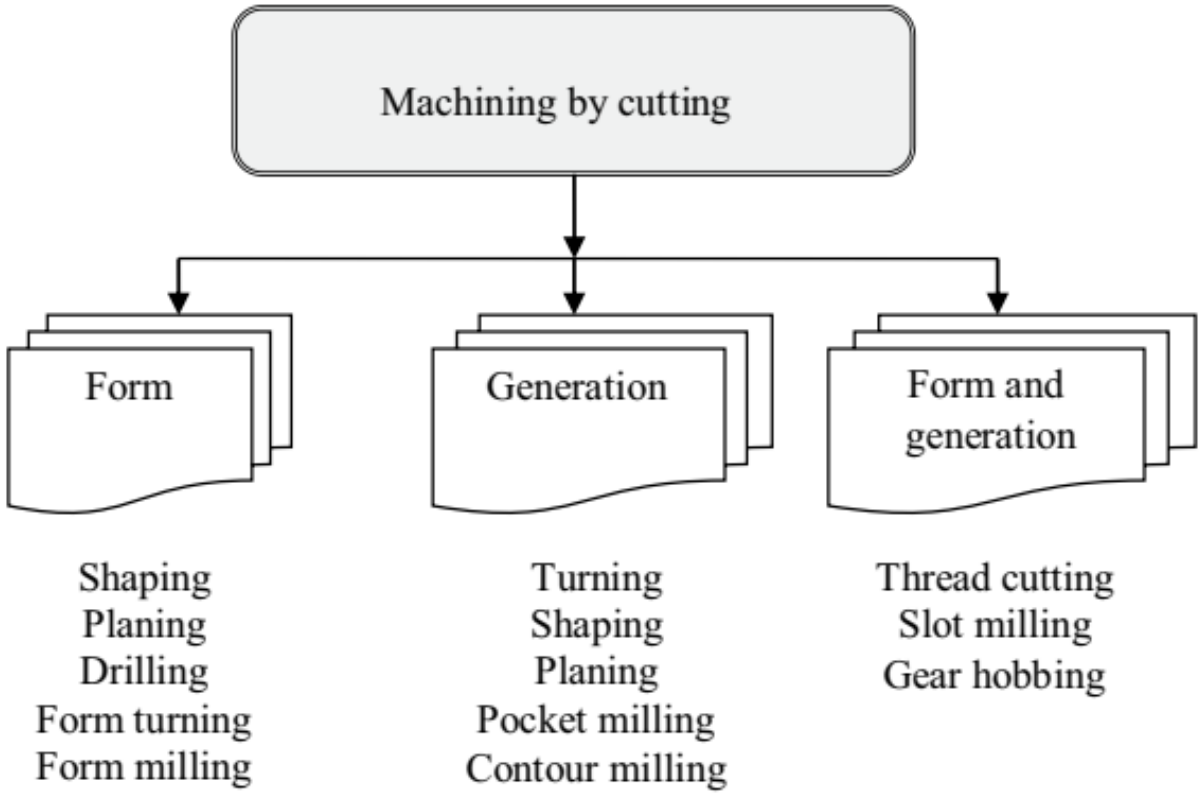


INTRODUCTION TO METAL CUTTING



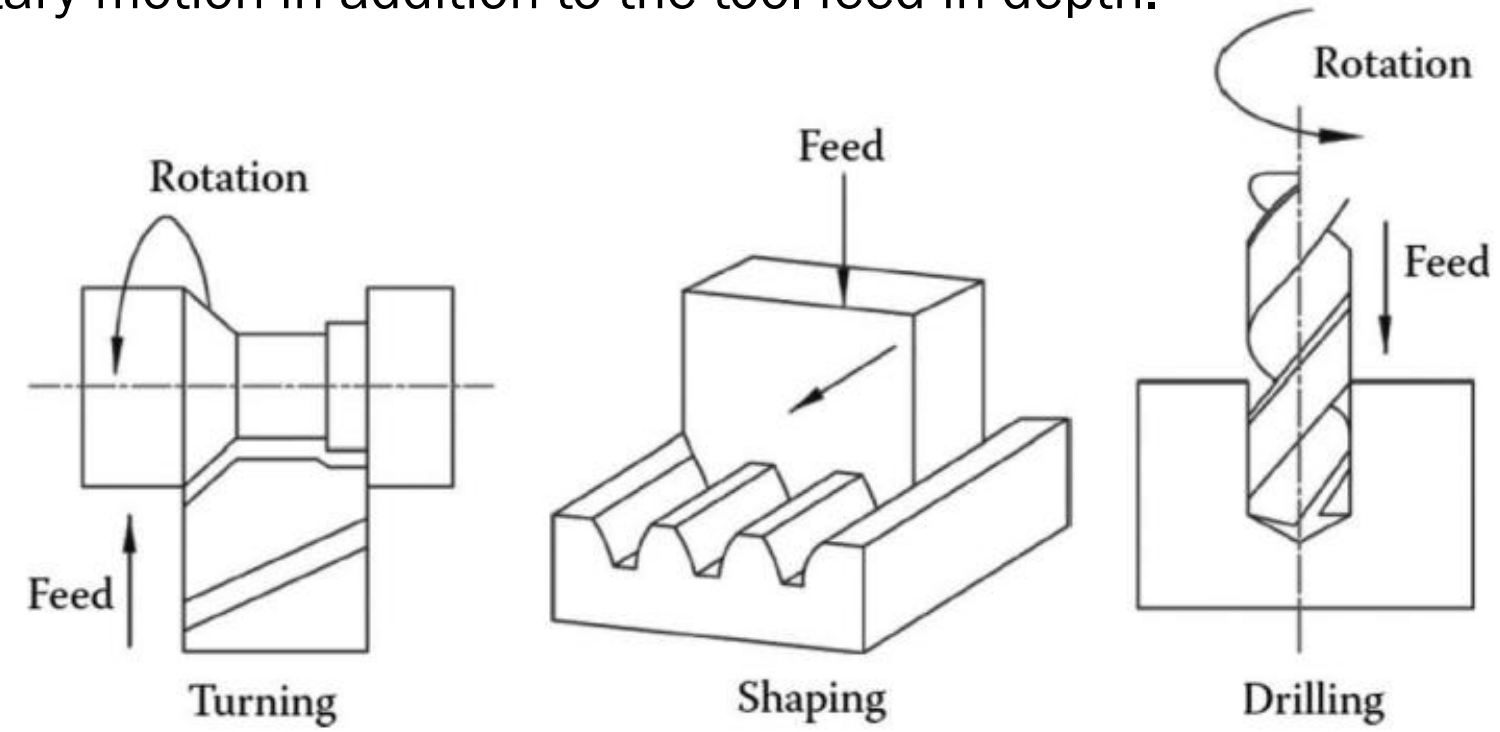
INTRODUCTION TO METAL CUTTING

- In **machining by Cutting**: The tool penetrates the workpiece as far as the depth of cut. The main components: tool, workpiece, and parts that controls workpiece and tool motions.



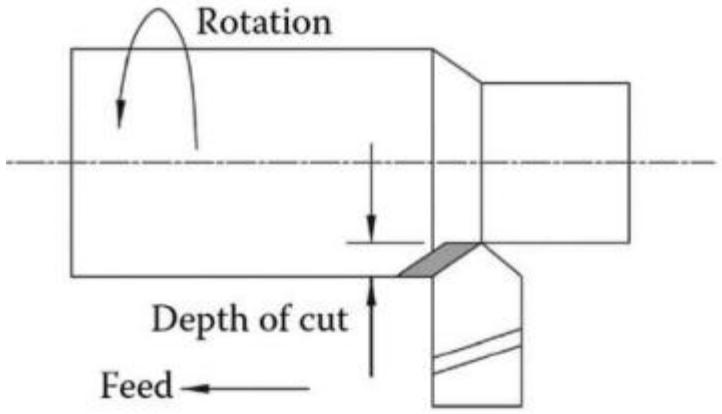
INTRODUCTION TO METAL CUTTING

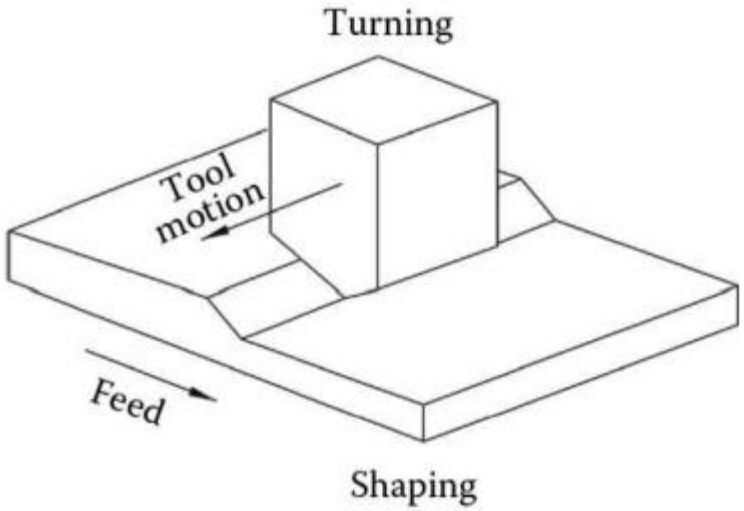
- **Form Cutting**: The shape of the workpiece is obtained when the cutting tool possesses the finished contour of the workpiece. The workpiece profile is formed through the main workpiece rotary motion in addition to the tool feed in depth.

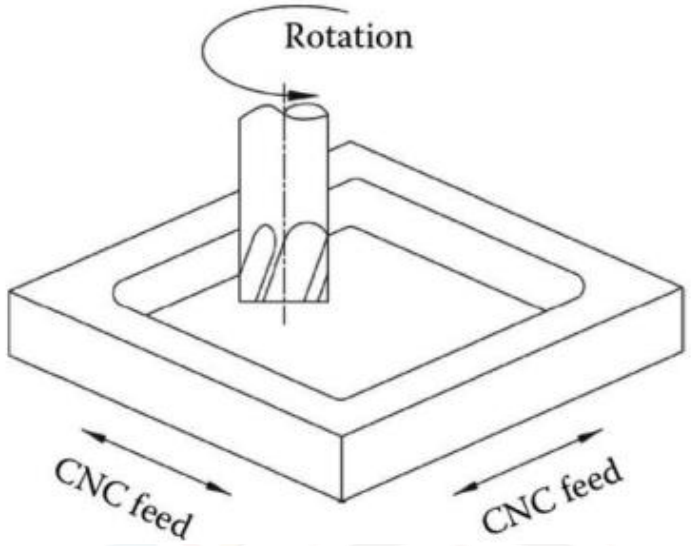


INTRODUCTION TO METAL CUTTING

- **Generation Cutting:** The workpiece is formed by providing the main motion to the workpiece and moving the tool point in the feed motion.

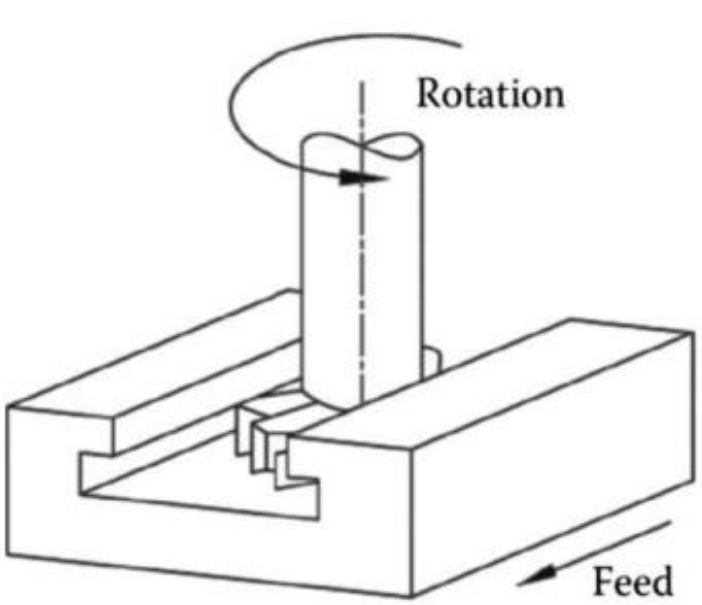




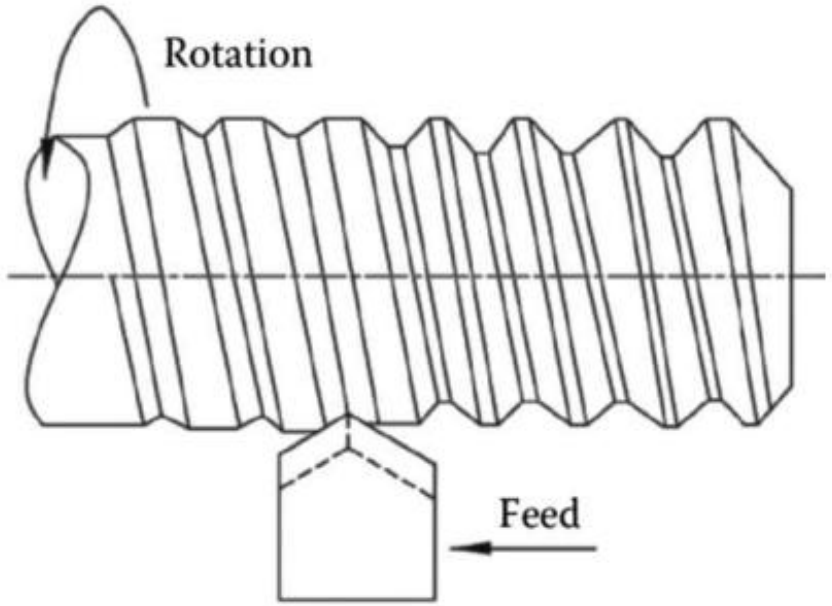


INTRODUCTION TO METAL CUTTING

- **Form and Generation Cutting:** During thread cutting, the tool having the thread form is allowed to feed axially at the appropriate rate while the workpiece rotates around its axis. Similarly, a slot can be milled by feeding the workpiece while rotating the form cutter.



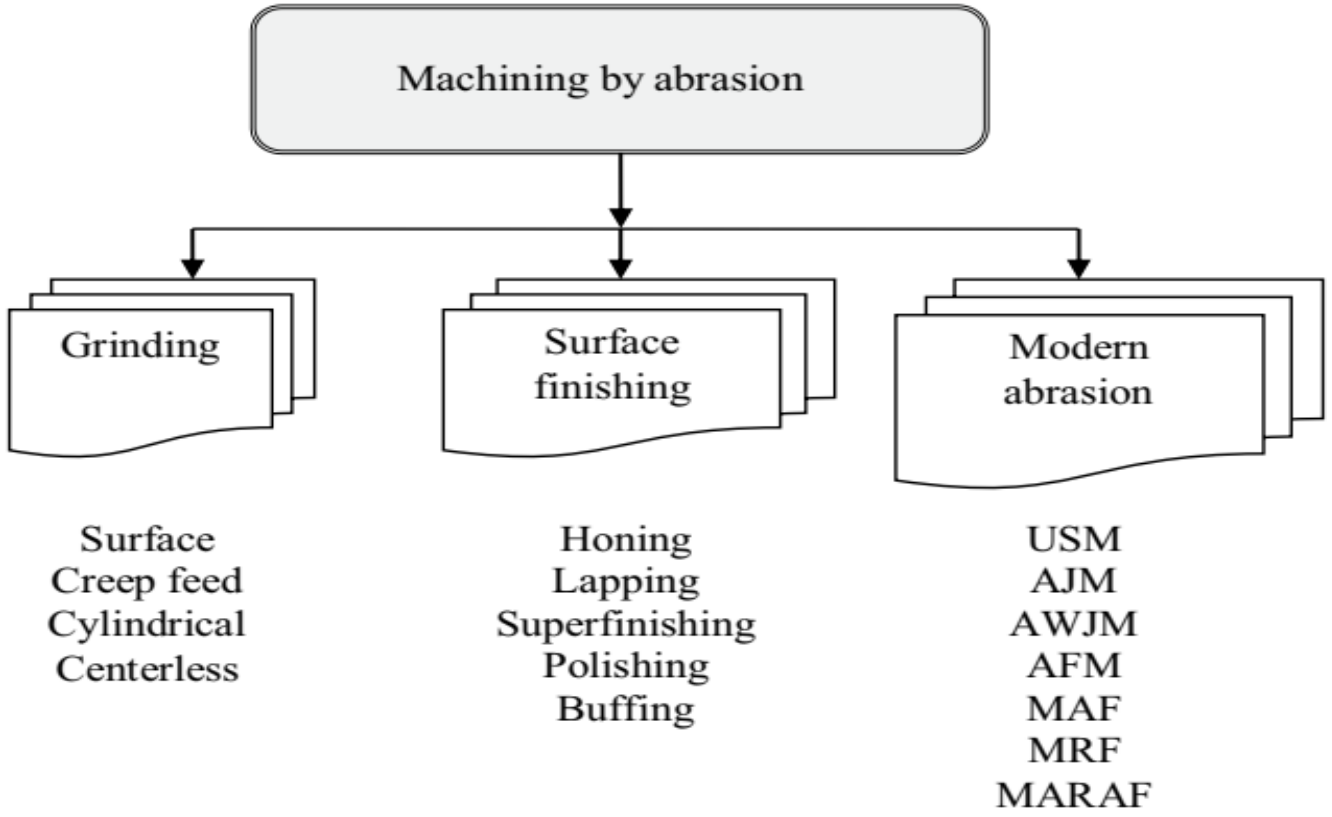
Slot milling



Thread cutting

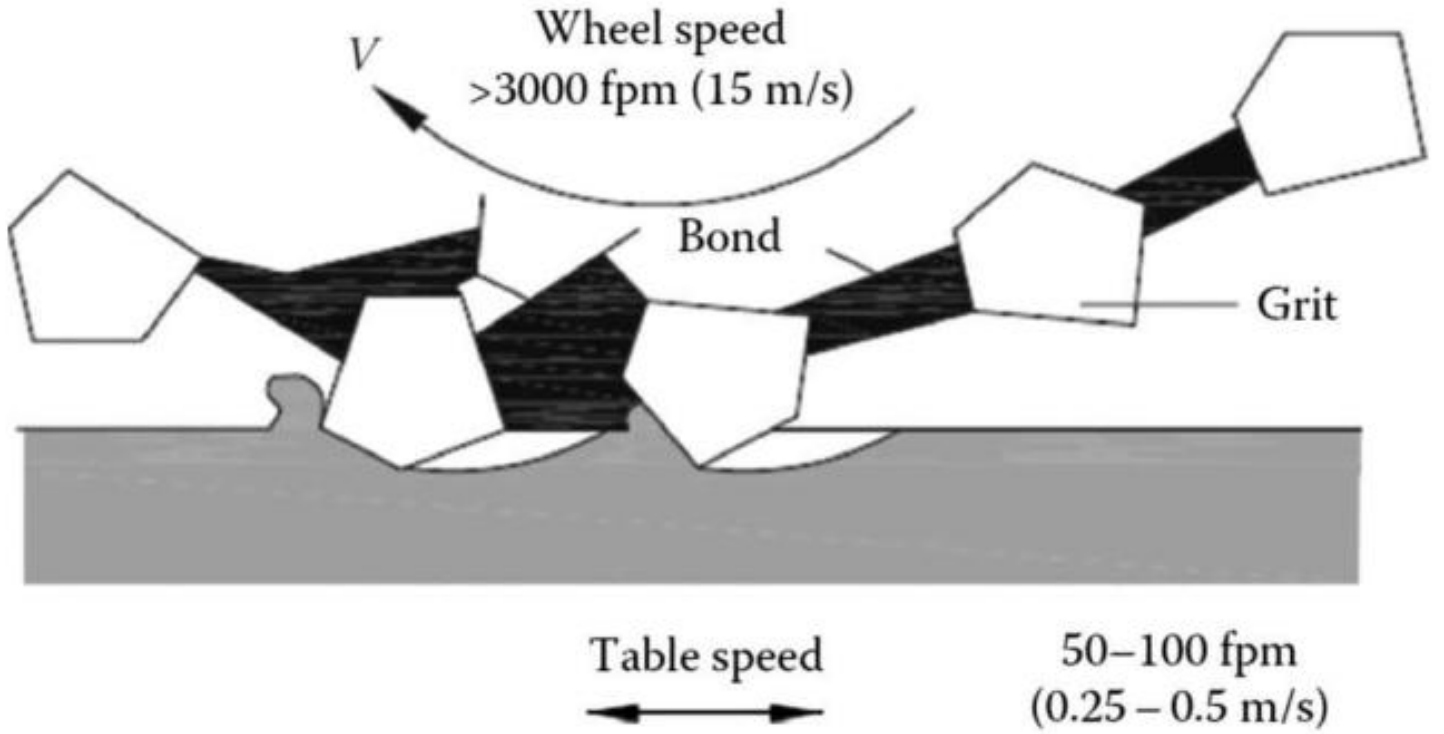
INTRODUCTION TO METAL CUTTING

- **Machining by Abrasion**: a small machining allowance is removed by a multitude of hard, small, angular abrasive grains of indefinite number and shape, may be loose or bonded.



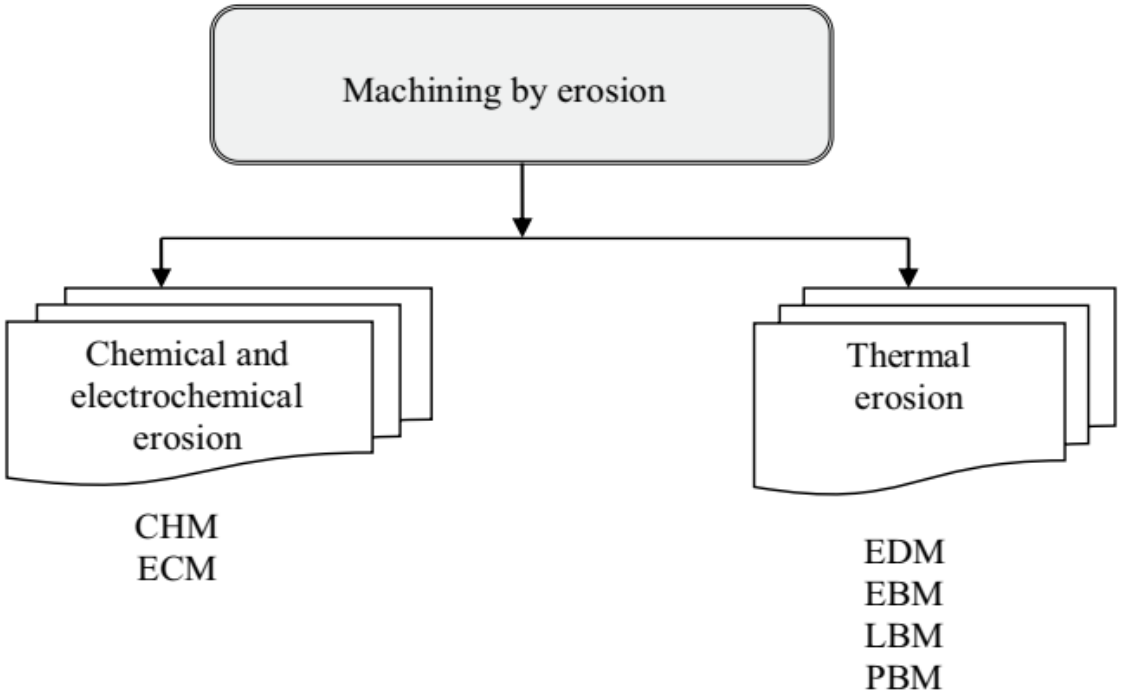
INTRODUCTION TO METAL CUTTING

- Example of abrasive machining include using a bonded abrasive wheel during grinding.



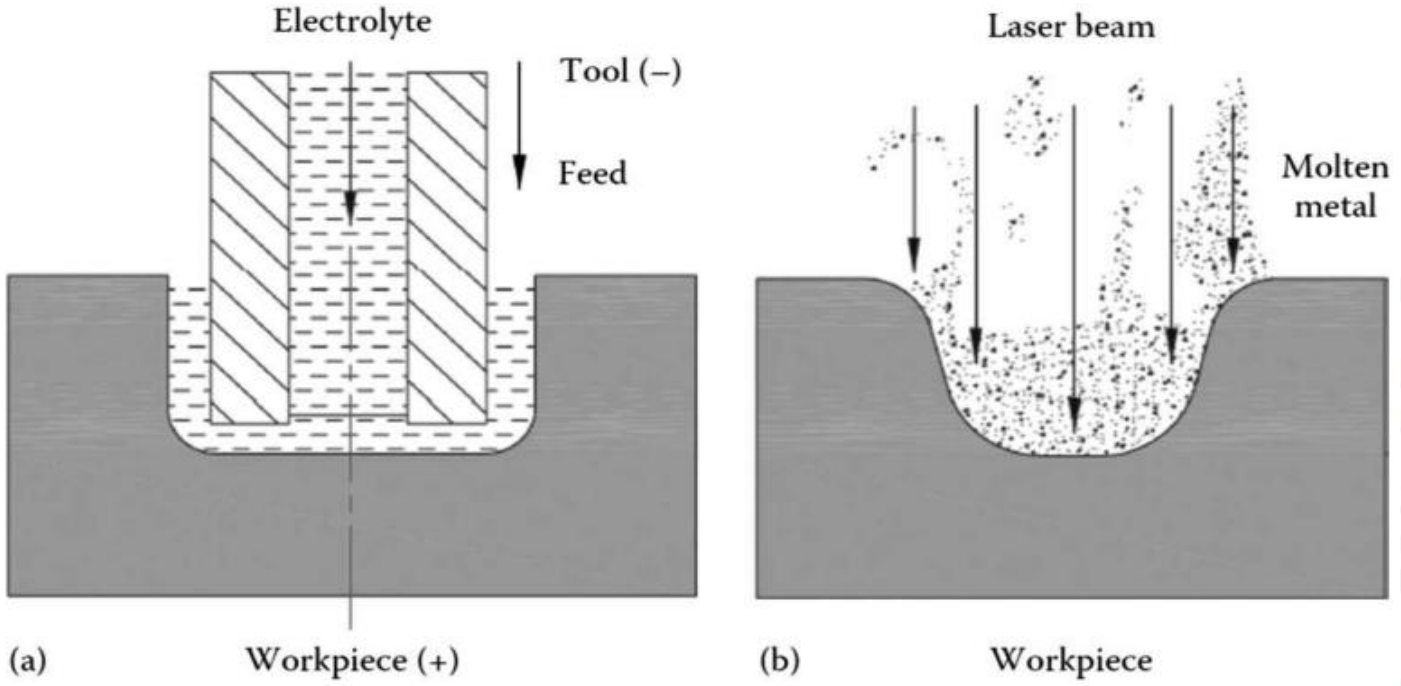
INTRODUCTION TO METAL CUTTING

- **Erosion Machining** do not produce chips or lay pattern on the machined surface; however, volumetric removal rates are much lower than with machining by cutting and abrasion. It removes successive layers of material as a result dissolution or melting and vaporization.



INTRODUCTION TO METAL CUTTING

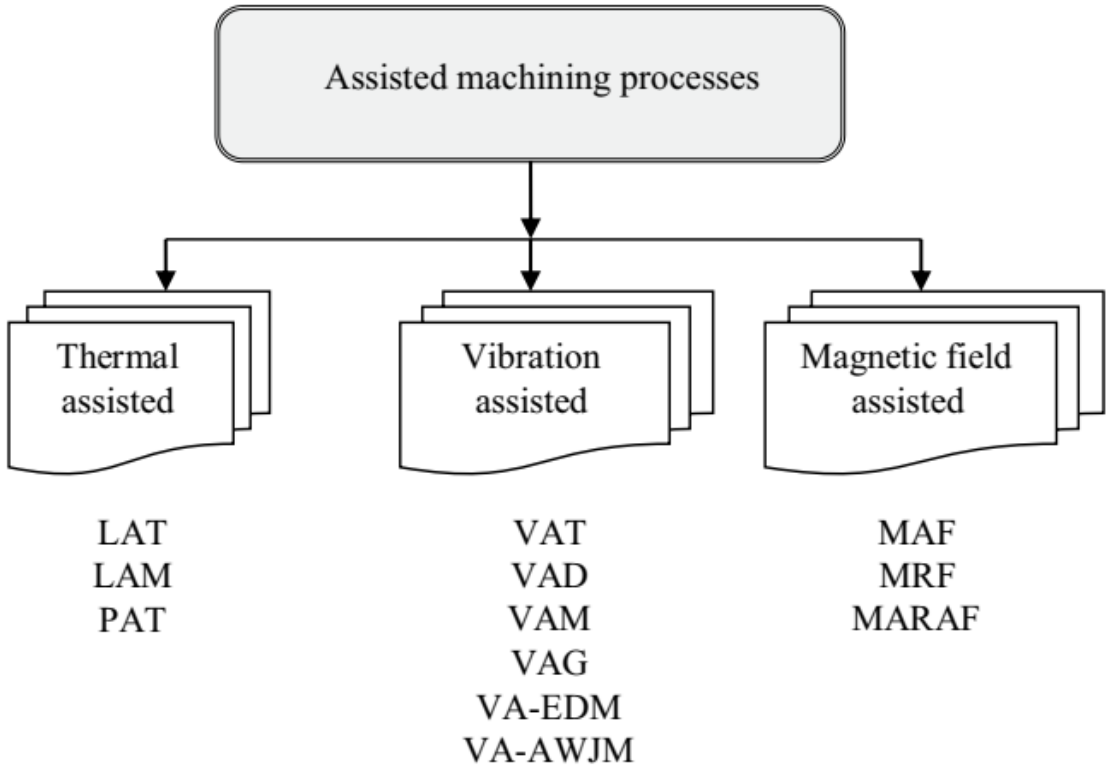
- Chemical and electrochemical erosion: chemical machining (CHM) or electrochemical machining (ECM). Thermal erosion: occurs by melting and vaporization of the workpiece material. Energy sources includes electric discharges, laser beams, electron beams, etc.



INTRODUCTION TO METAL CUTTING

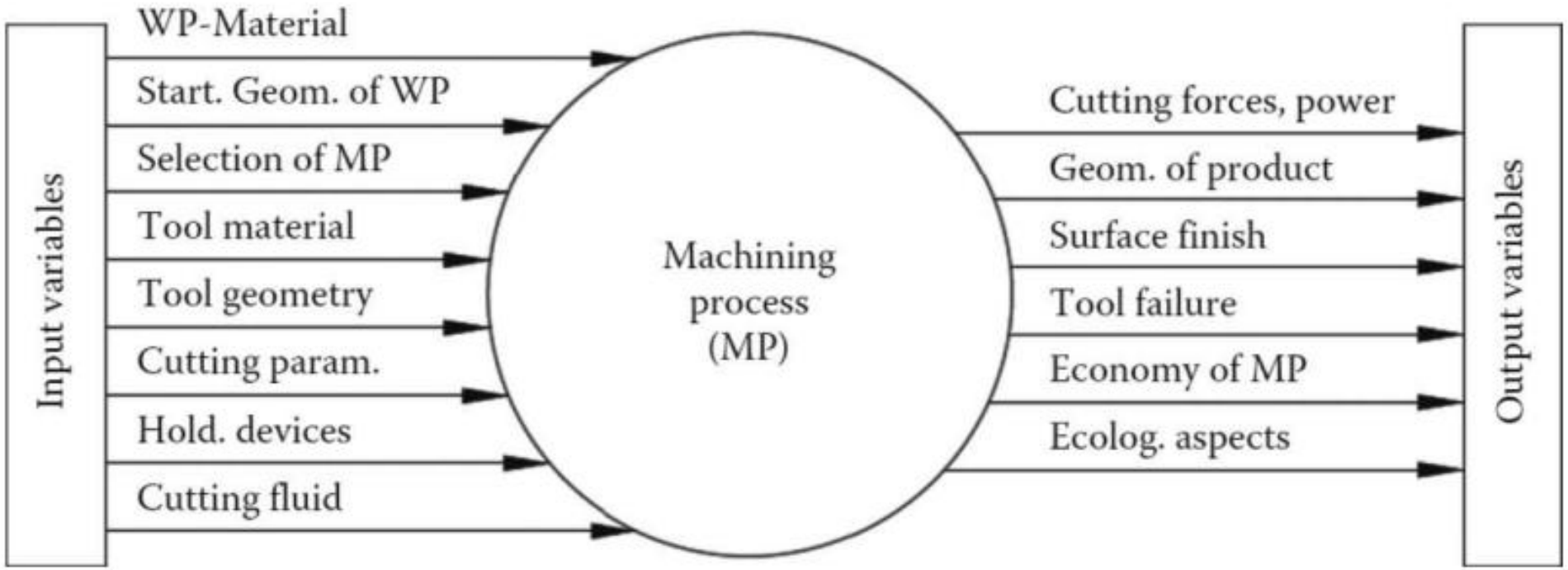
- The performance of some machining processes can be enhanced in terms of material removal rate, accuracy, and surface characteristics by introducing thermal, vibration, or magnetic assistance.

Laser assisted turning
Laser assisted milling
Plasma assisted turning
Vibration assisted turning
Vibration assisted drilling
Magnetic abrasive finishing
Magnetorheological finishing
Magnetorheological abrasive flow finishing.



INTRODUCTION TO METAL CUTTING

- Input parameters and output variables of machining:



Classroom

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END OF LECTURE