Ch:01 Introduction

1.1 Limitation of Conventional manufacturing processes

The basic objective of all machining operations is to remove the excess material to obtain the desired shape and size. In the development of harder and difficult-to-machine material such as hastalloy, Carbides, Stainless steel, Titanium alloy, Inconel, heat resisting steels, and many other high-~~temp~~-Strength-temp-resistant (HSTR) alloys. These materials find wide application in aerospace, nuclear engineering and other industries owing to their high Strength-to-weight ratio, hardness and heat resisting qualities. For such material Conventional edged tool machining is highly uneconomical and the degree of accuracy and surface finish attainable are poor. So Conventional machining process that ~~have~~ involve chip formation have a number of limitations

(i) large amount of energy consumed.
(ii) unwanted distortion
(iii) Residual Stresses
(iv) Burrs
(v) Complex geometries may be difficult to produce

1.2: Need of unconventional manufacturing process (machining)

Non-conventional manufacturing process is defined as a group of processes that remove excess material by various techniques involving mechanical, thermal, electrical or chemical energy or combinations of these energies but do not use a sharp cutting tools as it needs to be used for Conventional manufacturing processes.

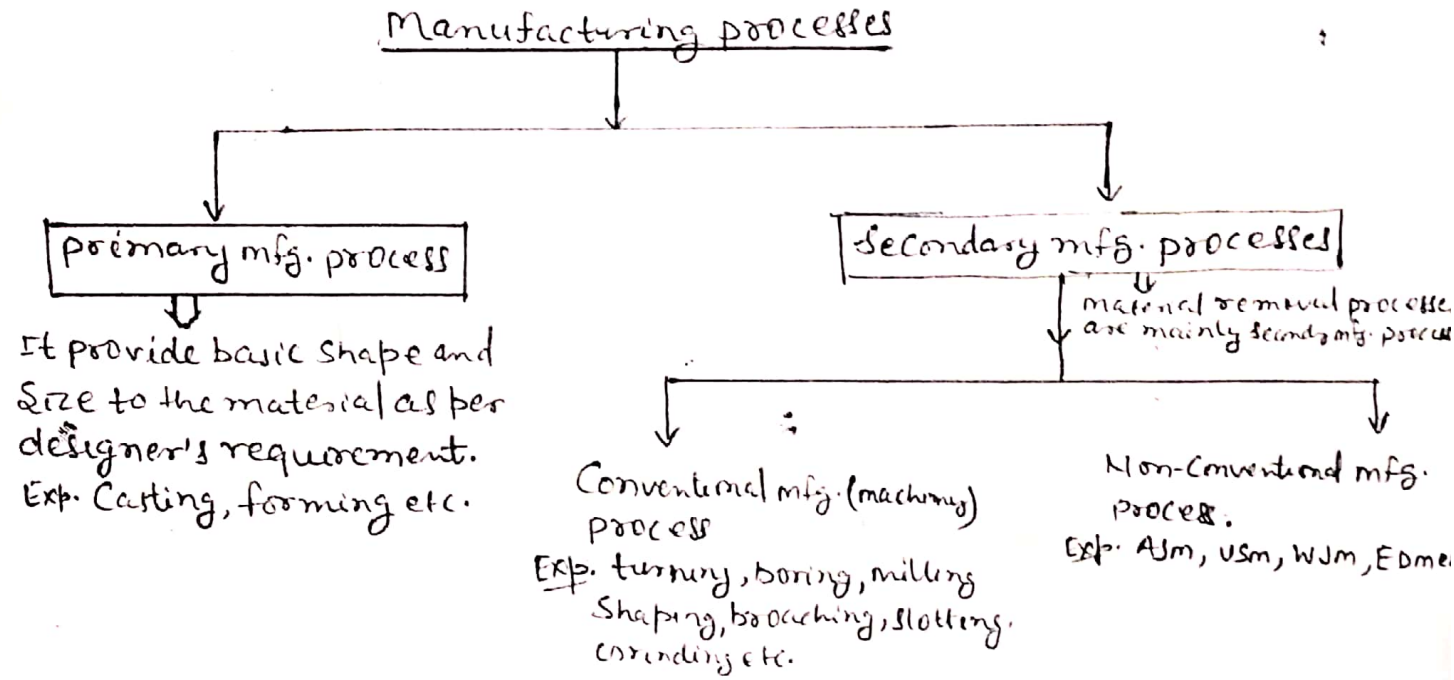
The major characteristics of Non-Conventional machining are:

(i) material removal may occur with chip formation or even no chip formation may take place.
(ii) there may not be a physical tool present.
(iii) In ... tool need not be harder

The following examples are provided where non-conventional manufacturing process Needed over the conventional machining process:

(a) Intricate shaped blind hole, eg Square hole of 15mm x 15mm with a depth of 30mm
(b) Difficult to machine material e.g Inconel, Ti-alloys or Carbide
(c) Low stress Grinding - Electrochemical grinding is preferred as Compared to Conventional grinding.
(d) Deep hole with small hole diameter
(e) machining of composites.

1.3: Classification



Classification of Non-Conventional mfg. process

It depends on the nature of energy used for material removal. the broad classification is given as follows

A. Mechanical process
- → Abrasive Jet machining (AJM)
- → ultrasonic machining (USM
- → water Jet machining (WJM)

B. Electrochemical processes
- → Electrochemical machining (ECM)
- → Electrochemical Grinding (ECG)
- → Electro Jet Drilling (EJD)

C. Electro-Thermal processes
- → Electro-discharge machining (EDM)

D. Chemical processes

→ Chemical milling (CHM)
→ Photochemical milling (PCM)

Table: Unconventional machining processes

Energy Type	Mechanics of material Removal	Energy Source	Process
Mechanical	Plastic Shear Erosion	Mechanical motion of Tool/Job mechanical/Fluid motion	Conventional machining Abrasive Jet m/cing (AJM) Ultrasonic machining (USM)
Electrochemical	Ion Displacement	Electric Current	Electrochemical machining (ECM)
mechanical and electro-chemical	Plastic Shear and Ion displacement	Electric current and mechanical motion	Electrochemical grinding (ECG)
Chemical	Corrosive Reaction	Corrosive Agent	Chemical machining (CHM)
thermal	Fusion and vaporization	Electric spark High speed Electrons	Electric Discharge machining (EDM) Electron beam machining (EBM)
thermal	Fusion and vaporization	powerful Radiation Ionized Substance	Laser beam machining (LBM) Plasma Arc machining (PAM)