The finish machining process is used to produce precise dimensions and surfaces to improve the aesthetics and sales value of manufactured products. Some common, popular methods of machining are honing, lapping, polishing, burnishing, and deburring.

The honing process is used mainly to obtain precise surface finishing of holes (internal surface) and external cylindrical surfaces or flat surfaces. Compared with grinding, the honing process is a low-speed operation producing cooler chips, with little or no damage/distortion of the material surface. Honing, an abrasive finishing operation, removes material from the internal or external surface of a part. This process is capable of high material removal rates and offers advantages of low-cost equipment. An accuracy of 0.001 mm can be obtained in a wide range of materials.

Lapping is an abrasive finishing operation used on flat or cylindrical surfaces. It utilizes a rough chemical-mechanical-polishing technique for an improved surface finish and accuracy and provides better wear life of a part. It is intended to only remove approximately 0.01 mm of material. The lap, which is usually made of softer material, is attached to an abrasive material or may be used with a slurry to cut harder material.

Burnishing is a cold working process primarily used to polish internal surfaces by utilizing plastic deformation and without actual removal of metal. As the tool passes through a work part, pressure is generated and exceeds the yield point of the work part, this results in the material exhibiting plastic flow. This allows the high spots to be flattened out and the valleys to be filled in. Cold working causes the work part to harden and produces a wear- and corrosion-resistant surface with a mirror-like finish.

Polishing is a process by which a smooth, glossy, and finished surface is produced either by fine-scale abrasive removal or by softening and smearing of surface layers by frictional heating during polishing. Chemical mechanical polishing uses a ceramic slurry in a sodium hydroxide solution when a chemically reactive surface (silicon wafer) is polished.

Thin ridges or small parts sticking to the newly machined surface, known as burrs, generally develop during machining along the edges of the work part. Deburring is the removal of these burrs, and there are various deburring processes available. Deburring is important for functionality, quality, aesthetics, and the smooth operation of work pieces.

Finish machining and net-shape forming of micro-parts are being investigated more because the demand for high-precision components (such as for the aerospace and automotive industry and for medical implants and instruments) has necessitated using micro-machining and net-forming techniques as opposed to conventional methods, which may lead to material wastage. Materials, processing conditions, tools, and machinery are some of the key factors that influence the manufacturing of quality products. These factors have received increased attention because of their roles in creating quality products. Over the years, advancements in micro-machining have been made through the application of light amplification by stimulated emissions of radiation (LASER), which is referred to as laser beam machining (LBM). Similarly, net-shape techniques such as die forming, investment casting, powder injection molding (PIM), and, more recently, additive layer manufacturing (ALM) comprising 3D printing using metal and plastic have been found to be cost-effective for micro-fabrication of intricate and complex micro-parts.

It is now clear that the use of conventional machining has been constrained because of the intricate shape and micro/nano size of the feature’s design, as has the emergence of advanced engineering materials. Therefore, stringent micro-fabrication techniques are required. Some commonly used techniques involve boring, such as ultrasonic-assisted lapping, gear honing, polishing, electrical discharge machining (EDM), laser beam machining (LBM), etching, coning, and micro-injection molding (μIM). These techniques are presented in this volume in two chapters covering μIM.
The volume contains chapters on finish machining, EDM/WEDM, gear manufacturing, micro-machining, laser machining, and net-shape micro-fabrication techniques. The content of each chapter is sufficient to give the reader background information about comprehensive finishing and net-shape forming techniques. Furthermore, the chapters are arranged to provide a progressive understanding of the various techniques as applied in practice. Therefore, it is expected that the reader will find this volume to be a great source for pertinent information on comprehensive finishing and net-shape forming.

**Concluding Remarks**

The contributions by the authors of this volume are excellent pieces of information relevant to researchers, technologists, students, and industrialists. Current research trends as well as research outlooks in the fields of comprehensive finishing and net-shape forming are presented in this volume.

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