



CIRP UNIFIED KEYWORD LIST

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The use of keywords in the abstract of papers is fundamental for the documentation of papers and articles in the international scientific world. The CIRP community has always been aware of this requirement and, to this aim, the working group on UNIFICATION has prepared and continuously updated the CIRP UNIFIED KEYWORD LIST, which **must** be used by all the authors of papers in the CIRP Annals and in any other publication under the CIRP heading. While preparing the abstract of your paper, you have to identify your paper with **three** keywords from the list in the following order:

- The first keyword identifying the general subject of the paper
- Two following keywords to detail particular aspects of the paper.

The keywords should be used in singular form, with the first letter in upper case, as they appear in the list. Authors may use the third keyword free, taking into account new emerging areas. The free keyword should always be **the last** one. The keywords should be separated by a **comma**.

The Technical Secretary

3D image processing

3D printing

Abrasion

Accuracy

Acoustic emission

Active damping

Actuator

Adaptive control

Adaptive manufacturing

Additive manufacturing (AM)

Algorithm

Alignment

Alloy

Aluminium

Analysis

Anisotropy

Artificial intelligence

Assembly(ing)

Atomic force microscopy (AFM)

Augmented reality

Automation

Ball screw

Bearing

Bending

Binder jetting (BJT)

Biologically inspired design

Biomedical

Blanking

Bonding

Boring

Brittleness

Burr

Calibration

Carbide

Casting

Ceramic

Chatter

Chemical vapor deposition
(CVD)

Chip

CO₂ emission

Coating

Cognitive robotics

Cold forming

Cold spray

Compensation

Complexity

Composite

Computer aided design (CAD)

Computer aided manufacturing
(CAM)

Computer automated process
planning (CAPP)

Computer numerical control
(CNC)

Conceptual design

Concurrent engineering

Condition monitoring

Control

Cooling

Coordinate measuring machine
(CMM)

Cost

Cryogenic machining

Cubic boron nitride (CBN)

Customisation

Cutting

Cutting edge

Cutting tool

Damage

Damping

Deburring

Decision making

Deep drawing

Deep hole drilling

Defect

Deformation

Delamination

Design

Design method

Design optimization

Development

Diamond

Diamond coating

Diamond tool

Die

Digital manufacturing system

Digital twin

Direct printing

Directed energy deposition (DED)

Disassembly

Discrete element method

Distributed control

Distributed design

Distributed manufacturing

Dressing

Drilling

Drive

Dynamics

Eco-design methodology

Economics

Electric vehicle

Electrical discharge machining (EDM)
 Electro chemical machining (ECM)
 Electrode
 Electrolyte jet
 Electron beam
 Emergent synthesis
 Encoder
 End milling
 Energy
 Energy efficiency
 Environment(al)
 Ergonomics
 Error
 Etching
 Evaluation
 Explainable artificial intelligence (AI)
 Extrusion
Factory
 Failure
 Fatigue
 Feed
 Feed drive
 Feedback
 Fiber reinforced plastic
 Finishing
 Finite element method (FEM)
 Flatness
 Flexibility
 Flexible manufacturing system (FMS)
 Flow
 Fluid
 Force
 Forging
 Forming
 Fracture analysis
 Free forming
 Friction
 Friction stir welding
 Fuel cell
 Fused deposition
 Fuzzy logic
Gear
 Generative artificial intelligence (GenAI)
 Genetic
 Geometric modelling
 Geometry
 Glass
 Grinding
 Grinding wheel
Handling
 Hard machining
 Hardening
 Hardness
 Heat partition(ing)
 Heat treatment
 High strength steel
 Honing
 Hot deformation
 Hot stamping
 Human aspect
 Human robot collaboration
 Hybrid machining
 Hybrid manufacturing
 Hydroforming
Identification
 Incremental sheet forming
 Information
 Injection
 Injection molding (or moulding)
 In-process measurement
 Inspection
 Integration
 Interferometry
 Ion beam
Joining
Kinematic
 Knowledge based system
 Knowledge management
Lapping
 Large language model(s)
 Laser
 Laser beam machining (LBM)
 Laser micro machining
 Laser welding
 Learning
 Lifecycle
 Linear motor
 Logistics
 Lubrication
Machinability
 Machine
 Machine tool
 Machining
 Machine learning
 Magnesium
 Magnetic bearing
 Maintenance
 Management
 Manipulator
 Man-machine system
 Manufacturing
 Manufacturing network
 Manufacturing process
 Manufacturing system
 Mass customization
 Material
 Material extrusion (MEX)
 Material jetting (MJT)
 Material removal
 Measurement
 Measuring instrument
 Mechanism
 Mechatronic
 Melting
 MEMS
 Metal
 Metal forming
 Metal matrix composite
 Methodology
 Metrology
 Micro forming
 Micro machining
 Micro structure
 Micro tool
 Milling
 Miniaturization
 Model
 Modelling
 Modular design
 Mold (or Mould)
 Molding (or Moulding)
 Monitoring
 Motion
 Multi-level modelling
Nano indentation
 Nano manufacturing
 Nano structure
 Nano technology
 Network
 Neural network
 Nickel alloy
Object recognition
 Observer
 Open architecture
 Operations management
 Optical
 Optimization
Parallel kinematics
 Part
 Pattern recognition
 Performance
 Phase transformation
 Photochemical machining
 Physical vapour deposition (PVD)
 Piezoelectric
 Planning
 Plasma
 Plate forging
 Polishing
 Polymer
 Positioning
 Powder
 Powder bed fusion (PBF)
 Precision

Predictive model
 Press
 Probe
 Process
 Process control
 Processing
 Product
 Product development
 Production
 Production planning
 Productivity
 Profile
 Programming
 Prototyping
 Punching
 PVD-coating
Quality
 Quality assurance
 Quality control
 Quenching
Reconfiguration
 Recycling
 Reliability
 Remanufacturing
 Replication
 Residual stress
 Reverse engineering
 Robot
 Rolling
 Roughness
 Roundness
Safety
 Scanning electron microscope
 (SEM)
 Scanning tunnelling microscopy
 (STM)
 Scheduling
 Selective laser melting (SLM)
 Selective laser sintering (SLS)
 Semiconductor
 Sensor
 Sequencing
 Service
 Servo system
 Shape memory alloy
 Sheet lamination (SHL)
 Sheet metal
 Silicon
 Silicon carbide
 Simulation
 Single crystal
 Sintering
 Soldering
 Spindle
 Spline
 Springback
 Stability
 Stainless steel
 Stamping
 Standardization
 Statistical process control (SPC)
 Steel
 Stereo lithography
 Stiffness
 Straightness
 Strain
 Stress
 Structural analysis
 Structure
 Super abrasive
 Surface
 Surface analysis
 Surface integrity
 Surface modification
 Sustainable development
 Sustainable machining
 Synthesis
 System
 System architecture
Tapping
 Temperature
 Tensile strength
 Texture
 Thermal effect
 Thermal error
 Titanium
 Tolerancing
 Tool
 Tool geometry
 Tool path
 Topography
 Tribology
 Turning
Ultra precision
 Ultra-high strength steel
 Ultrasonic
 Uncertainty
 Vat photopolymerization (VPP)
Vibration
 Virtual reality
 Visual inspection
Waterjet machining
 Wear
 Welding
 Wire EDM
 Workpiece
X-ray
Y
Z