

1. Keywords

Keywords consist of two types: Standardized and Author-selected.

1.1 Standardized Keywords

Select the first keyword from Category 1 in the Standardized Keywords, the second one from Category 2, and the third one from Category 3.

1.2 Author-selected Keywords

The author selects suitable keywords from the title and/or main text in accordance with procedure below.

- (1) Select phrases that have specific meanings and are as narrowly defined as possible.

(NA) Critical, Speed \Rightarrow Critical Speed

(NA) Life \Rightarrow Tool Life, Fatigue Life

- (2) Use noun forms

(NA) Studied Experimentally \Rightarrow Experimental Study

- (3) Limit the use of abbreviations to those that are widely and globally used in the particular field.
(As a rule, author-invented terms must not be used.)

(NA) ATC \Rightarrow Automatic Tool Change, Automatic Train Control

- (4) Compound words and phrases must be ones that are commonly used.

(NA) Fatigue Strength at Elevated Temperature

\Rightarrow Fatigue Strength, Elevated Temperature

- (5) Spell out the full names of alloys, chemical compounds, elements, and nuclides instead of using symbols.

(NA) CrMo Steel \Rightarrow Chromium Molybdenum Steel

(NA) Al₂O₃ \Rightarrow Aluminum Oxide

(NA) Cu \Rightarrow Copper

- (6) When there are multiple words with the same or similar meanings, choose the most concise and frequently-used one.

- (7) If unsure whether to include or delete any content, include it.

Automotive Technology: Standardized Keywords

(*): Items marked with an asterisk are spelled out in the definition.

Category Code	Purpose/field	Objects/hardware/software	Means/details/component technologies
	Category 1	Category 2	Category 3
(A1)	heat engine	<ul style="list-style-type: none"> • compression ignition engine • spark ignition engine • homogeneous charge compression ignition • new combustion model/new combustion model engine • rotary engine/rotary combustion engine • Stirling engine • gas turbine/steam turbine • engine component or element • turbocharger/variable geometry turbo • supercharger • variable valve train • engine accessory • turbo compound • post treatment system • three-way catalyst • de-NOx catalyst/selective catalytic reduction NOx removal/NOx reduction catalyst (*) • particulate filter • fuel/alternative fuel • gasoline/light oil (gas oil/diesel oil) /heavy oil • ethanol/bio-diesel fuel (*) • liquefied petroleum gas/natural gas/hydrogen • dimethyl ether/Fischer-Tropsch synthetic oil (*) • lubricating oil/engine oil 	<ul style="list-style-type: none"> • measurement/diagnosis/evaluation • numerical calculation • design/control • theory/modeling • performance/fuel economy/efficiency • combustion analysis • emissions gas/harmful emissions • fuel injection/fuel spray • intake and exhaust • supercharging • mixture formation/gas flow • fuel improvement/fuel reforming • additive • lubrication/tribology • vibration/noise • cooling
(A2)	power transmission	<ul style="list-style-type: none"> • start control system • transmission • differential/final reduction gear • manual transmission • automatic transmission • continuously variable transmission (*) • automated manual transmission/dual clutch (*) • new type transmission • transfer • all-wheel drive system (*) • hybrid system • drive axle/joint • clutch system • gear/gear system • drivetrain • belt drive/traction drive/chain drive • control system • hydraulic equipment • synchromesh • bearing • lubricating oil/transmission oil 	<ul style="list-style-type: none"> • machining • material • strength • fatigue • mechanism
(A3)	EV and HV systems	<ul style="list-style-type: none"> • motor • motor drive system 	<ul style="list-style-type: none"> • motor characteristics • electric power conversion

		<ul style="list-style-type: none"> • inverter/converter • power control unit • battery technology • lithium ion battery/nickel-metal hydride battery (nickel hydrogen battery)/lead-acid battery • state of charge (SOC) (*) • charge/discharge • onboard charging system • power storage system • electrical accessories/air conditioning • accessories • plug-in hybrid • fuel cell • stack cell • hydrogen tank • hydrogen production/hydrogen reforming • energy replenishment/hydrogen filling/infrastructure • energy control system • brake control/regenerative-friction brake coordination 	<ul style="list-style-type: none"> • energy regeneration • system technology • filling infrastructure • power split • insulation • standardization • regulation • electrical safety (electric shock prevention) • electromagnetic compatibility (*) • policy of popularization • energy balance • energy management • cooling/heat and temperature management
(B1)	vehicle dynamics	<ul style="list-style-type: none"> • electronic stability control • suspension system • electronically controlled • brake system • brake-by-wire/antilock brake system (ABS) (*) • steering system • steer-by-wire/power steering • tire/wheel • chassis/component • adaptive cruise control system • lane-keeping assistance system • electronic stability control • motorcycle/heavy duty vehicle/special vehicle/aircraft 	<ul style="list-style-type: none"> • motion control • vehicle dynamics • evaluation technology • driver model • driving stability • dynamic model • road environment recognition • driver intention recognition
(B2)	vehicle development	<ul style="list-style-type: none"> • platform • computer-aided design (CAD)/computer aided manufacturing/computer aided engineering (*) • personal mobility • body shell/white body/body in white • bumper/body model • instrument panel • seat/lighting • design • hardware in the loop simulation (*) 	<ul style="list-style-type: none"> • performance plan • exterior/interior • color • body structure/body design • structural member analysis • vehicle plan • weight reduction • design optimization/robust design • design simulation/design • tool/design modeling • rapid prototyping/virtual planning • vehicle application • motor sports • reliability • load simulation
(B3)	vibration, noise, and ride comfort	<ul style="list-style-type: none"> • power train/body (vehicle body)/engine mounting system • intake and exhaust system/drive line (drivetrain) • suspension system (suspension) • brake/tire • body structure/body material • acoustic material • accessory and device noise • idling vibration/idling 	<ul style="list-style-type: none"> CAE simulation/forecast/optimization (*) • finite element method (FEM)/boundary element method (BEM) • evaluation technology/measurement technology/sound source search technology • multi-body dynamics • statistical energy analysis

		<ul style="list-style-type: none"> • noise/acceleration noise • booming noise/vibration • quietness • drumming noise (low frequency road noise) • road noise/pattern noise • powertrain oscillation (powertrain start/vehicle start/shift) • whine/growl/beat noise [powertrain/drive line (drivetrain)] • gear noise • ride comfort • harshness • shimmy • body vibration while driving • wind noise • brake noise/judder • exterior noise/noise regulation 	<ul style="list-style-type: none"> • full-vehicle simulation • test and analysis technology • optimization technique • sound quality evaluation/ride comfort evaluation • device technology/control technology • modal analysis/transfer path analysis/fluid induced noise analysis
(C1)	safety	<ul style="list-style-type: none"> • passive safety (collision safety/crash safety)/fire safety/active safety/combined active and passive safety/integration control/integrated control • safety education • material flammability test • suppression system • first aid/occupant protection/pedestrian and bicycle and motorcycle rider protection/protection for vulnerable road users • accident avoidance/collision prediction • crash test • rear end collision/side impact/frontal collision • fire protection • pre-crash • compatibility • driving simulator • air bag/seat belt • anthropomorphic dummy/crash test dummy • drive recorder/event data recorder • body structure • seat/head restraint • protection of older people/child protection • child restraint system (*) • expectant mother protection • pedestrian detection/protection • automatic brake • damage mitigation brake/warning • intelligent vehicle • adaptive cruise control (*) • road environment • intersection camera • injury database • critical safety system • seat belt reminder • automatic crash notification/automatic collision notification • doctor helicopter/doctor car • licensing system 	<ul style="list-style-type: none"> • road environment recognition • image processing/information processing • intelligent/computer application • occupant detection/occupant safety • damage mitigation • energy-absorbance and impact attenuation • accident analysis/statistical accident analysis • accident investigation and analysis • near-miss analysis • survival rate/start of initial • injury prediction • injury mechanism • accident reconstruction/accident re-creation • anthropomorphic dummy • rollover • sensor technology • injury tolerance of older people/characteristics of older drivers • injured area/impacting area • abbreviated injury scale • vehicle dynamics control/airbag control • lane-keeping control • navigation system • vehicle-to-vehicle and infrastructure-to-vehicle communication • driving support/driver support • injury severity score (*) • macro data/micro data • risk curve • risk • delta-v/change in velocity • evasive action • test/evaluation • third-party evaluation • regulation • computer aided engineering (*)

		<ul style="list-style-type: none"> • injury criteria • impactor • helmet 	
(C2)	human engineering	<ul style="list-style-type: none"> • older person [people] • human body injury • biomechanics • bioinstrumentation/driving • driver condition • cognitive reaction time • drowsiness/alcohol drinking • task load/driver burden • cardiometry • risk compensation • overconfidence/disaffection • car sickness/aroma/awakening • fatigue/burden • destruction • workload • risk recognition • human error • sensitivity/vision/visibility • human machine interface (*) • warning system • information systems • intent determination • driving ability • drive recorder • questionnaire form/interview • driving act/driver behavior • usability • thermal environment • driving position • mental model • facial expression 	<ul style="list-style-type: none"> • older person [people] support • experiment ethic/engineering ethic • stress/subjective view/performance evaluation • human interface • driver sensing /driver monitoring • driver model/rider model • driver condition monitoring • driver characteristics/driver behavior/driver fatigue/driver attention • driving characteristics • driving simulator • field of vision/visibility/operability/controllability/ ease of egress and ingress/comfort • sense of hearing/sense of force/sense of touch • recognition/judgment • operation • driving posture • difference among individuals • mental burden/physical burden • cerebral nerve system/musculoskeletal system • bioinstrumentation/biomechanics • driving support/driver support • alarm/warning • physiological measurement • automatic nervous system/central nervous system/endocrine • visual system/olfactory system • morphological and dynamic characteristics/perceptual and sensory characteristics • operation amount (steering wheel angle)/operational performance • behavior observation • mental and physical fatigue
(D1)	heat • fluid	<ul style="list-style-type: none"> • body/vehicle body/engine/intake and exhaust system/part element • aerodynamic performance/aerodynamic noise • radiator/oil cooler • oil cooling system/air cooling system • air conditioner • refrigerant • air quality/odor 	<ul style="list-style-type: none"> • computational fluid dynamics (*) • wind tunnel test • algorithm/modeling • interior environment • engine cooling • air conditioning/comfort • temperature control/environmental control • heat damage
(D2)	environment • energy • resources	<ul style="list-style-type: none"> • recycling • reuse • rare metal/rare earth • ISO14000 • sunlight/wind power • life cycle assessment (*) • air quality/water quality/soil environment • emissions/emission gas • fuel economy/thermal efficiency • new energy 	<ul style="list-style-type: none"> • environmentally conscious production • environment-oriented production design/recycle design • maintenance • standard • international environmental policy/policy analysis • material recycling • life cycle management • design/production • long service life technology

		<ul style="list-style-type: none"> • recyclable energy/renewable energy • fuel/alternative fuel • hazardous air pollutant • heat-trapping gas/greenhouse gas • volatile organic compound 	<ul style="list-style-type: none"> • regulation/policy/marketing • health effects • evaluation mode • global standard harmony • manufacturing/use/disposal stage • energy manufacturing • climate change
(D3)	materials	<ul style="list-style-type: none"> • iron and steel materials • low carbon steel sheet/mild steel sheet/high-strength steel sheet/surface treated steel sheet • stainless steel • special steel • cast iron • sintering material/powder alloy • non-ferrous material • aluminum alloy/magnesium alloy/titanium alloy • composite material • polymer material • elastomer • polymer composite material • surface mount chip or sheet molding compound (*) • plastic recycling • instrument panel • bumper/body/vehicle body/exterior • interior/seat • adhesive • paint • engine component • seal/gasket • window glass • structural ceramics/electroceramics • secondary battery material (rechargeable battery material)/material for motor • magnetic steel sheet • electrolyte • permanent magnet • catalyst • grease 	<ul style="list-style-type: none"> • test/evaluation • modeling • load simulation • reliability/robust design • rust prevention • weight reduction/mass reduction • strength/stiffness/rigidity/wear resistance • fatigue • anticorrosion/stray current corrosion/electrolytic corrosion • addition • heat treatment/quenching • surface treatment/plating • casting/forging • joining/coupling/welding • press technology/stamping technology • process • smelting • workability/recyclability • impact resistance/transparence • heat resistance/oil resistance/ fuel resistance/water resistance/light resistance/light fastness • smoothness • insulation performance • nanotechnology • fracture/oxidation/deterioration/degradation/heat resistance • magnetic characteristics • friction
(D4)	production • manufacture	<ul style="list-style-type: none"> • formed and fabricated materials • forming process • additional machining • teamwork design • quantity production prototyping • casting/forging/assembly/painting/rig/trim • production plan/manufacturing plan/production management/manufacturing control • quality control/supply control/schedule control/schedule management • die/mold • heat treatment/surface treatment • equipment/maintenance/maintenance • procurement/purchase • continuous production • product lifecycle management/bill of materials/product data management/manufacturing 	<ul style="list-style-type: none"> • planning/design/simulation • material/cost • press/resin (plastics) • machining/high energy density machining • joining/welding/weld overlay • computer-aided testing /evaluation/quality (*) • inspection/measurement • design/prototyping • module • total cost

		execution system (*)	
(E1)	electronics and control	<ul style="list-style-type: none"> • engine control/transmission control/chassis control • passive safety control/active safety control/intelligent safety control • integration control/vehicle body control/by-wire control/electric vehicle and hybrid electric vehicle control (*) • electronic device/power device • microprocessor/large scale integrated circuit (*) • electronic control unit/power control unit (*) • millimeter wave radar/laser (*) radar/ultra wide band • semiconductor camera/infrared camera • device/operation device/warning and information device • parking assist system • light emitting diode light (*) • physical sensor/chemical sensor • micro electro mechanical systems (*) • driver state detection control system/security control system • control simulation/hardware in the loop simulation (*) • environmentally friendly car electronics • human machine interface display/human machine interface operation/human machine interface information provision system (*) • control navigation • image recognition system/speech recognition system • electrical actuator • electromagnetic compatibility (electromagnetic interference/electromagnetic susceptibility) (*) • on-board multiplex communication system • light • event data recorder (*) • on-board diagnostics (*) • wiring harness/wire harness/electrical system wire harness • software platform • robotics • control system/autonomous land system/autonomous driving system • electrical system 	<ul style="list-style-type: none"> • test/measurement/diagnosis • reliability/simulation • control system/software • data transfer and storage • hardware and software standardization • information management • electronic properties • electric circuit/electronic circuit • vehicle sensor/actuator • image processing • on-road test/duration test/durability test/parts level test • new measuring technique • intelligent • system engineering • functional safety • electrical equipment • package/assembly/packaging technology
(E2)	information, communication, and control	<ul style="list-style-type: none"> • controller area network (*) • AUTOSAR • Bluetooth • vehicle to grid (*) • power line communication (*) • wireless local area network • drive recorder • vehicle navigation system/communication system 	<ul style="list-style-type: none"> • inter-vehicle communication/vehicle-to-vehicle communication • information system • audio • navigation system • environment recognition • communication system • interior network/vehicle network

		<ul style="list-style-type: none"> • FlexRay • high-speed communication • ultra wide band communication • Internet communication • smart grid • cloud system • remote diagnostics • local interconnect network • traffic information • HD Radio (*) • portable navigation device/personal navigation device (*) • network traceability • Worldwide Interoperability for Microwave Access • digital watermark technology • secure communication protocol 	<ul style="list-style-type: none"> • information technology/intelligent transport system (*) • media information • eco-drive/environmentally friendly driving • speech recognition • optical communication • web contents • distributed processing system • multi-core CPU • operating system
(F1)	social system	<ul style="list-style-type: none"> • energy-saving driving • electricity-based society systems 	<ul style="list-style-type: none"> • traffic environment • traffic engineering • traffic stream • safety education • road
(F2)	common infrastructure	<ul style="list-style-type: none"> • onboard measurement • durability test • information management • parts level test • computer-aided design/computer aided manufacturing/computer aided engineering (*) 	<ul style="list-style-type: none"> • experiment with a mode • simulation/modeling • design • maintenance/maintenance/protection • service • rapid prototyping • virtual planning • repair • diagnostic device • warranty • monitoring • data transfer and storage • standard/regulation • regulation/certification • quality assurance • policy proposal • intellectual property • engineering education/training • history of automotive technology
(F3)	other means of mobility	<ul style="list-style-type: none"> • airplane • avionics • marine/shipping • aerospace • rail • personal mobility 	

Abbreviation	Full spelling	Abbreviation	Full spelling
ABS	Antilock Brake System	HEV	Hybrid Electric Vehicle
ACC	Adaptive Cruise Control	HILS	Hardware In the Loop Simulation
AMT	Automated Manual Transmission	HMI	Human Machine Interface
AWD	All Wheel Drive	ISS	Injury Severity Score
BDF	Bio Diesel Fuel	IT	Information Technology
BOM	Bills of Materials	ITS	Intelligent Transport System
CAD	Computer Aided Design	LCA	Life Cycle Assessment
CAE	Computer Aided Engineering	LED	Light Emitting Diode
CAM	Computer Aided Manufacturing	LIN	Local Interconnect Network
CAN	Controller Area Network	LSI	Large Scale Integration Circuit
CAT	Computer Aided Testing	MEMS	Micro Electro Mechanical Systems
CFD	Computational Fluid Dynamics	MES	Manufacturing Execution System
CRS	Child Restraint System	OBD	On Board Diagnosis
CVT	Continuously Variable Transmission	PCU	Power Control Unit
DCT	Dual Clutch Transmission	PDM	Product Data Management
DME	Dimethyl Ether	PLC	Power Line Communications
ECU	Electronic Control Unit	PLM	Product Lifecycle Management
EDR	Event Data Recorder	PND	Portable Navigation Device
EMC	Electromagnetic Compatibility	SCR	Selective Catalytic Reduction
EMI	Electromagnetic Interference	SMC	Sheet Molding Compound
EMS	Electromagnetic Susceptibility	SOC	State Of Charg
EV	Electric Vehicle	UWB	Ultra Wide Band
FT	Fischer Tropsch	V2G	Vehicle to Grid
HD	High Definition	VOC	Volatile Organic Compounds