SI Units — Measurements and Equivalencies

Stan Jakuba
S. R. Jakub Associates,
West Hartford, CT

Throughout the history of civilization attempts have been made to limit the number of the measuring systems in use with the result that today only two systems, English and metric, are practiced in the industrial nations. Globally, the metric system has been gaining ground, and the English system has been losing it. As of 1986, only the United States, Burma and Brunei remain uncommitted to metric conversion in the sense that no government controlled deadlines for the conversion have been established. In the U.S., the lack of governmental leadership is surprising in light of the importance our founding fathers placed on the need to adopt a systematic and decimal set of measures in this country. Thanks to Thomas Jefferson, our nation was first to have a decimal coinage plan (ten cents to a dime, ten dimes to a dollar); he also proposed the division of a day into decimal increments — a measure which still awaits acceptance. Despite the present lack of governmental involvement, metrification has been progressing, particularly in the automotive and export oriented industries. The conversion is guided by various engineering and educational societies, and there is an agreement among them to establish the so-called SI version of the metric system here.

The abbreviation SI has been adopted by all languages of the world to denote the International System of Units. SI was created in 1960, and it is intended to serve the needs of professionals as well as the general public worldwide. SI is distinguised by its coherent set of units; there is only one unit for any physical quantity in such a system. If, for example, the English system were coherent, it would have only one unit of length, and that unit would replace all other length and length-related units such as angstrom, mil, foot, acre, pint, gallon, bushel and barrel; conversely, instead of ounce, which denotes two different volumes, two different masses and a force, it would have an individual unit for each of the three quantities. A coherent system has no conversion factors and is easy to learn.

AUTHOR:

MR. STAN JAKUBA *has over twenty years experience in the gear industry in the United States and overseas. President of S.R. Jakub Associates, Engineering and Training Consultants, Mr. Jakuba was educated in Czechoslovakia and holds a masters degree in mechanical engineering from MIT. He is the holder of several patents for engineering products and is a member of ASME and SAE. He is also secretary of the U.S. Metric Association.*

The two systems practiced today, English and metric, have been revised several times in their history and are concurrently used in more than one version. As we know, this country uses the U.S. version of the English system, a version which has most units defined on metric standards and which also employs metric units. We also know that other English speaking countries have used the Imperial version. It is not so well known that most metric countries have used a mixture of several versions of the metric system, such as cgs, MKS, gravitational and SI.

By now, most industrial nations have imposed mandates requiring the exclusive use of SI units. There is, however, a large body of metric literature, drawings and standards which contain old and obsolete units. Furthermore, not every company and every department within a company has implemented the mandate yet, and thus non-SI units are still appearing. A person trying to learn SI by studying documents which contain metric data faces a confusing ordeal.

The purpose of the following charts is to bring some order to this multiplicity of units and aid the engineer or technician in making necessary conversions.

Table I is a chart of U.S. customary and SI units arranged in the alphabetical order of their respective physical quantities. About fifty quantities are listed, selected to cover the common mechanical engineering disciplines.

Experience indicates that the resistance against SI data and SI calculations stems largely from the lack of the feel for the "ball park figures." To provide some feel, the table includes a column of Typical Values with approximately one hundred and fifty engineering constants and reference numbers.

The column of the SI units shows their symbols in the form best suited for typing. Prefixes are included where a particular prefix is always encountered in engineering practice, such as dimension (mm) and kinematic viscosity (mm^2/s), and also in the case of the kg. The numbers in the Typical Values column provide a guide for the selection of suitable prefixes for the other quantities.

SI Equivalents

The numbers are rounded off to satisfy common engineering accuracy. The use of table is illustrated at the end.

Acceleration: longitudinal

1 ft/sec^2	is	0.305	m/s^2
1 in/sec^2	is	0.0254	m/s^2
1g	is	9.81	m/s^2

(continued on page 48)

SI UNITS – MEASUREMENTS . . .

(continued from page 10)

TABLE I

Quantity	Example of Usage	US Customary Units	SI Units	Typical Values
Acceler.: longitudinal angular	vehicle, gravity, valve train crankshaft, governor	ft/sec^2, g, in/sec^2 deg/sec^2, rad/sec^2	m/s^2 rad/s^2	dragster: 20m/s^2, earth gravity: 9.8 m/s^2, cam follower: 1000 m/s^2 dragster wheel: 40 rad/s^2
Angle: figure descrip. engineering	geometric pictures twist, dynamics of rotation	deg, min, sec rad, degree	rad[deg] rad	one radian is 57.3 degrees 6.28 rad is one revolution
Area Coeff. of therm. exp.	cross-section, land measure shrink fit, volumetric growth	in^2, ft^2, acre 1/°F	m^2 1/K	office space per person: 10 m^2, discharge port: 4 mm^2, nozzle orifice: 0.12 mm^2 aluminum alloy: 22 μm/m•K, steel: 11 μm/m•K, kerosene: 1 dm^3/m^3•K, water: 0.18 dm^3/m^3-K, water: 0.18 dm^3/m^3-K
Density Dimension	mass density, specific weight mech. engineering design	lb/ft^3, lb/gal in	kg/m^3 mm	diesel fuel: 870 kg/m^3 water: 1000kg/m^3, aluminum alloy: 2700 kg/m^3, steel: 7850 kg/m^3 rotor dia: 23.410, rotor dia. tolerance: ±0.004, car length: 5730
Energy: general specific	work, heat, electricity energy content in fuel	ft-lb, Btu, kW-h Btu/lb	J J/kg	60 W bulb: 5 MJ in one day, diet soft drink: 4 kJ, 1 MJ of electricity costs 2¢ diesel fuel: 42 MJ/kg, methanol: 20 MJ/kg
Flow Force	See mass flow or volume flow. weight, thrust, drag	 oz, lb, ton	 N	 big man exerts 1000 N force of gravity on earth
Frequency: angular cycle rotational	See angular velocity. vibration pulsing rpm, rps	 c/min, c/sec r/min, r/sec	 Hz 1/s	 athlete's heart at rest: 1 Hz, middle "C": 261.6 Hz, engine vibrates at 300 Hz induction motor: 30 1/s, small genset: 60 1/s, truck turbocharger: 2000 1/s
Fuel cons.: transport	highway economy	mile/gal	km/dm^3	car: 10 km/dm^3, truck: 2 km/dm^3 (dm^3 = liter)
Specific Heat	See specific fuel consumption See energy.			
Length Load	distance See mass or force	mil, in, ft, yd	m	dime thick.: 1mm, man height: 170 cm, "ideal" form: 90-60-90, jets fly at 10 km alt. 102 kg mass exerts 165 N force of gravity on moon, 1 kN on earth, 275 kN on sun
Mass: object flow	weight, load, inertia flow rate, fuel consumption	oz, lb, ton, slug lb/min	kg kg/s	1 dm^3 contains 1 kg of water, average man has mass of 70 kg, truck has mass of 30 Mg car engine fuel flow: 2 g/s, rocket engine: 100 kg/s
Modulus of: elasticity section	longit.(E), shear(G), volumet.(K) bending and twist calcul.(W)	lb/in^2 in^3	GPa m^3	steel: E = 200 GPa, G = 80 GPa; diesel fuel: K = 1.5 GPa rod of 10 mm diameter: W = 100 mm^3 in bending, 200 mm^3 in torsion
Moment of: area, 1st area, 2nd force inertia	centroid of shape bending and twist calculation torque, bending couple dynamics of rot., Flywheel Effect	in^3 in^4 ft-lb, in-lb lb-in-sec^2, lb-ft^2	m^3 m^4 N•m kg•m^2	 rod of 10 mm diameter: 2nd moment = 500 mm^4 in bending, 1000 mm^4 in torsion 1dm^3 engine torque: 100 N•m, discharge fitting installation torque: 80 N•m flywheel of a car engine: 0.1 kg•m^2, truck engine: 2 kg•m^2
Power Pressure	heating, engine stress, vacuum, injection	Btu/min, hp psi, inHg, inH$_2$O	W Pa	av. man: 100 W cont., small kerosene heater: 2000 W, House furnace: 40 kW, car: 60 kW filter Δp: 70 Pa, earth atm.: 100 kPa, tire: 200 kPa, BMEP: 1.2 MPa, diesel injec.: 50 MPa
Spec Energy Consump. Spec. Fuel Consumption	brake spec. energy consumption brake spec. fuel consumption	Btu/hp-h lb/hp-h	non-dim. g/MJ	engine 33% efficient has BSEC of 3 diesel engine: 80 g/MJ, gasoline engine: 100 g/MJ
Specific Gravity Speed	ratio of grav. forces or densities See frequency or velocity	dimensionless	not appl.	relative density of water is 1, of steel 7.85, if water is the reference substance
Spring rate: longitud. torsional	spring force per change in length spring torque per change in angle	lb/in deg/100 ft-lb	N/m N•m/rad	valve spring: 10 kN/m, car suspension: 30 kN/m, railroad car spring: 4MN/m torsionally soft drive shaft: 600 N•m/rad. torsionally stiff drive shaft: 300 kN•m/rad
Stress Temperature	See pressure. fever, melting point	 °F, °R	 K [°C]	strength of steel-tensile: 900 MPa, bending: 200 MPa human body: 37°C, ice melts at 273 K (0°C), steel is hot forged at 1300 K
Time: daily schedule engineering	clock, events of daily life flow measurement, elapsed time	h, min h, min, sec	[h, min] s	60 min in 1h, 24 h in 1 day 1 ks is 17 min, 100 ks is approx. 1 day, 1 revolution takes 20 ms at 50 rev./s
Torque Vacuum	See moment of force. See pressure.			 100% vacuum: 0 Pa absolute pressure, 50% vacuum: 50 kPa pressure differential
Velocity: longitudinal peripheral	vehicle, boat, fuel plume, cam grinding wheel, fan tip	mile/h, knot ft/min	m/s m/s	athlete: 10 m/s, speed lim.: 25 m/s (88 km/h), sound in air: 333 m/s, in water: 1444 m/s grinding speed: 50 m/s
angular Viscosity: kinematic	2π X freq. of rotation fuel property, lubrication	deg/sec, deg/min centistokes	rad/s mm^2/s	100 rev./s is 628 rad/s water: 1mm^2/s, diesel fuel: 5 mm^2/s at 20°C, lub. oil: 10 mm^2/s at 100°C
Volume: content flow	tank, milk, cylinder fuel flow, air flow rate	qt, gal, in^3, ft^3 ft^3/min, yd^3/min	m^3 m^3/s	1 quart is approximately 1 dm^3, beverage can is 1/3 of dm^3 air usage of a marathon runner: 1 dm^3/s, car engine: 100 dm^3/s
Weight: Object specific	See mass or force. See density or specific gravity.			
Work	See energy.			

(continued on page 50)

SI UNITS – MEASUREMENTS . . .

(continued from page 48)

Acceleration: angular

1 degree/sec^2	is	0.0175	rad/s^2

Angle

1 degree	is	0.0175	rad
1 min	is	0.291	mrad

Area

1 acre	is	4047	m^2
1 ft^2	is	0.093	m^2
1 hectare	is	0.01	km^2
1 in^2	is	645	mm^2
1 yard^2	is	0.836	m^2

Coefficient of thermal expansion

1/°F	is		1.8/K

Density (i.e., specific mass. For relative density see specific gravity.)

1 lb$_m$/ft^3	is	16.02	kg/m^3
1 lb$_m$/in^3	is	27.68	Mg/m^3
1 lb$_m$/gal (US)	is	119.8	kg/m^3
1 kg/dm^3 or g/cm^3	is	1000.	kg/m^3

Note: The $_m$ and $_f$ subscripts are intended to distinguish between the two meanings of oz., lb., ton and the like. When these units refer to mass, the subscript m is used; when to force, the subscript f is used. In SI, the unit of mass is formed from the word gram, and the unit of force from the word newton. Whereas lb$_m$ and lb$_f$ are numerically the same for a given object on Earth, newton and gram differ. The lb$_m$/lb$_f$ distinction can be ignored in the common measurements of daily life, as the distinction makes no difference there. In some branches of engineering, however, and in converting to SI units, understandng the distinction is vital for avoiding errors. Some specific weight tables list the values derived from force units, not mass units. The potential error resulting from the use of the above conversion factors is 0 to 0.5%.

Dimension (is always in mm in Mech. Eng.)

1 ft	is	305
1 in	is	25.4
1 yard	is	914

Energy: general (including work)

1 Btu	is	1.055	kJ
1 cal (thermochemical)	is	4.19	J
1 Cal (usage in nutr.)	is	4.19	kJ
1 ft-lb$_f$	is	1.36	J
1 kg-m	is	9.81	J
1 kW-hr	is	3.6	MJ

Note: kg* = kg force, sometimes written kp.

Energy: specific

1 Btu/lb$_m$	is	2.33	kJ/kg
1 cal/g	is	4.19	kJ/kg

Flow: mass

1 lb$_m$/min	is	7.56	g/s
1 lb$_m$/sec	is	0.454	kg/s

Flow: volumetric

1 ft^3/min	is	0.472	dm^3/s
1 gal (US)/h	is	1.05	cm^3/s
1 gal (US)/min	is	63	cm^3/s

Force (incl. load, weight, etc., where they pertain to force)

1 dyne	is	0.01	mN
1 kg**	is	9.81	N
1 oz$_f$	is	0.278	N
1 lb$_f$	is	4.45	N
1 ton (short) force	is	8.90	kN
1 ton (metric) force	is	9.81	kN

Frequency: cycle

1 cpm	is	1/60	Hz

Frequency: rotational

1 rpm	is	1/60	1/s

Note: 1/s = s^{-1}. Both symbols represent the SI unit of rotational frequency, popularly known as speed, speed of rotation, revolutions per second, rps, and the like.

Fuel consumption: transportation (incl. economy)

1 lb$_m$/h	is	0.126	g/s
x liter/100 km	is	100/x	km/dm^3
1 mile/gal (US)	is	0.43	km/dm^3

Note: 235.2/mpg = liter per 100 km
235.2/liter per 100 km = mpg

Fuel consumption: specific

1 lb$_m$/hp (US)-h	is	169	μg/J
1 g/kW-h	is	0.278	μg/J

Length (See also dimension.)

1 ft	is	0.305	m
1 in	is	25.4	mm
1 mile (nautical)	is	1.85	km
1 mile (statute)	is	1.61	km
1 yard	is	0.91	m

Mass (incl. load, weight, etc., where they pertain to mass)

1 carat	is	0.2	g
1 oz$_m$ (avoirdupois)	is	28.35	g
1 oz$_m$ (troy)	is	31.10	g
1 lb$_m$	is	0.454	kg
1 slug	is	14.6	kg
1 ton (short) mass	is	0.907	Mg

Modulus of: elasticity

1 lb$_f$/in^2	is	6.89	kPa

Modulus of: section

1 in^3	is	16.4	cm^3

Moment of: area, 1st

1 in^3	is	16.4	cm^3

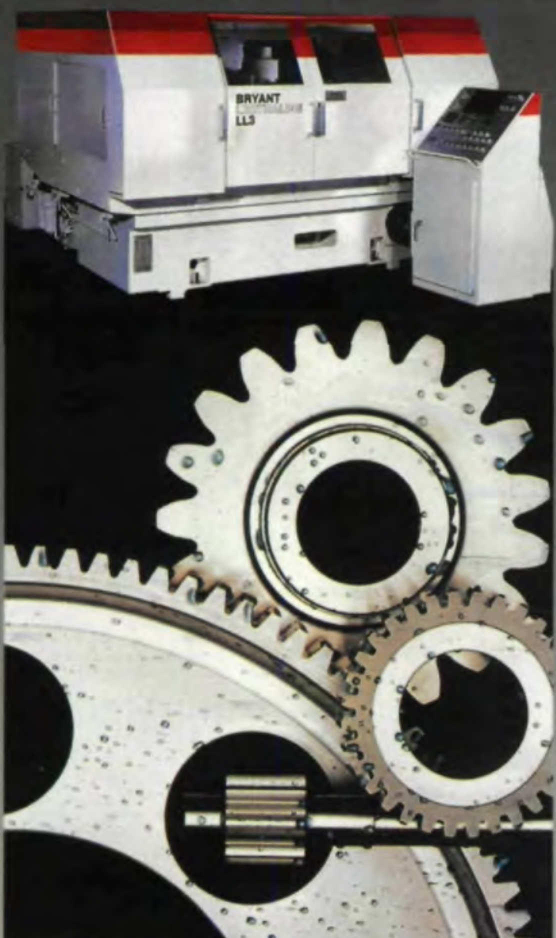
Moment of: area, 2nd

1 in^4	is	41.6	cm^4

(continued on page 52)

Tight grinding tolerances? Try a Bryant Grinder.

Overton Gear did — and returned for seconds!



The search ends! Quality and precision solutions found with Bryant Lectraline® CNC grinders.

Overton Gear and Tool Corporation of Addison, Illinois, a prime manufacturer of quality gears for commercial, industrial, and military applications, was prepared to purchase new precision grinding equipment. According to Overton President Tony Waitekus, "We were looking elsewhere when we heard of the innovatively designed Bryant Lectraline Grinder. We liked what we saw and were convinced that to compete and meet tighter tolerance requirements we had to go Bryant."

Since its installation, the Bryant Lectraline LL3-55 CNC grinder has been performing a multitude of precision ID, OD, and face grinding operations on a wide variety of gear types and sizes. According to A. Flores, Overton's Quality Control Manager, the Lectraline, in automatic cycle, maintains repeatability tolerances of 0.0002″ total size with 0.000040″ total straightness on a 2″ diameter, 2″ long, bore — without in-process gaging!

Mr. Waitekus states, "We could see the increased productivity and multiple machine capabilities the Lectraline had to offer." Mr. Flores adds, "With the Bryant we have experienced less scrap, less rework, a higher quality product, and production done in a fraction of the original time." Waitekus concludes, "The Bryant Lectraline more than met our expectations. The service and assistance we have received has been outstanding. Having the fullest confidence in the machine's performance we ordered a second."

If you're interested in quality and performance for your grinding operations contact Bryant Grinder Corporation, Springfield, Vermont 05156, (802) 885-5161.
We'll show you how to get it.

Bryant®

Gear Expo '87

Visit us at Booth #534.

Bryant Grinder TEXTRON

Bryant Grinder Corporation / Subsidiary of Textron Inc.

CIRCLE A-7 ON READER REPLY CARD

SI UNITS – MEASUREMENTS . . .

(continued from page 50)

Moment of: force (incl. torque and couple)

1 ft-lb_f	is	1.36	N•m
1 in-lb_f	is	0.113	N•m
1 in-oz_f	is	7.06	mN•m
1 kg-m	is	9.81	N•m

Note: The unit was also written as N•m/rad.

Moment of: inertia (incl. Flywheel Effect)

1 lb_f-in-sec^2	is	0.113	kg•m^2
1 lb_f-ft-sec^2	is	1.36	kg•m^2
1 kg-cm-sec^2	is	0.0981	kg•m^2
1 GD^2 (kg-m^2)	is	0.25	kg•m^2
1 GD^2 (kg-m-sec^2)	is	0.0255	kg•m^2
1 WD^2 (lb-ft^2)	is	0.168	kg•m^2
1 WD^2 (lb-in^2)	is	0.00117	kg•m^2
1 WR^2 (lb-ft^2)	is	0.0421	kg•m^2
1 WR^2 (lb-in^2)	is	0.00029	kg•m^2

Note: The unit was also written as kg•m^2/rad^2. GD, WD and WR represent the so-called flywheel effect. Flywheel effect has sometmes been used in place of the polar mass moment of inertia. The different symbols reflect the fact that flywheel effect may not have exactly the same meaning from country to country, or even within a country. To correctly convert them is really tricky.

Momentum

1 lb_m-ft/sec	is	0.138	kg•m/s
1 lb_m-in/sec	is	0.0115	kg•m/s

Power (incl. heat rate)

1 Btu/h	is	0.293	W
1 ft-lb_f/min	is	0.0226	W
1 hp (US, mech. eng.)	is	0.746	kW
1 hp (metric)	is	0.735	kW
1 ton (refrigeration)	is	3.52	kW

Pressure (incl. stress)

1 atm (internat.)	is	101.3	kPa
1 bar	is	100.0	kPa
1 kg/cm^2	is	98.1	kPa
1 $lb_f ft^2$	is	47.9	Pa
1 lb_f/in^2	is	6.89	kPa
1 inHg (60°F)	is	3.38	kPa
1 inH_2O (60°F)	is	0.249	kPa
1 mmHg (16°C)	is	133	Pa
1 mmH_2O (16°C)	is	9.80	Pa

Specific force of gravity (For specific mass see density.)

1 lb_f/ft^3	is	157	N/m^3
1 lb_f/in^3	is	271	kN/m^3
1 kg/dm^3	is	9.81	kN/m^3)

Specific gravity (meaning relative density)

Conversion of this nondimensional quantity to density in kg/m^3 or to specific force of gravity in kN/m^3, is a matter of multiplication by 1000 or by 9.81, respectively, when water is the reference mass.

Spring rate: longitudinal

1 lb_f/ft	is	14.6	N/m
1 lb_f/in	is	175	N/m

Spring rate: torsional

x deg/100 ft-lb_f	is	7.8/x	kN•m/rad
1 kg m/rad	is	9.81	N•m/rad
1 lb_f-ft/rad	is	1.36	N•m/rad
1 lb_f-in/rad	is	0.113	N•m/rad

Note: The unit was also written as N•m/rad^2.

Temperature

1°F=1°R (increment)	is	0.556	K
1°F=461°R (scale)	is	−16.8°C=256.4K	

$t_{°C}=(t_F-32)/1.8$
$t_K=(t_F+460)/1.8$
$t_K=5t_R/9$

Velocity (incl. angular)

1 deg/sec	is	0.0175	rad/s
1 ft/min	is	0.0051	m/s
1 ft/sec	is	0.305	m/s
1 in/sec	is	0.0254	m/s
1 km/h	is	0.278	m/s
1 knot (international)	is	0.515	m/s
1 mile (statute)/h	is	0.447	m/s

Viscosity

1 centipoise	is	1	mPa•s
1 centistokes	is	1	mm^2/s

Volume

1 barrel (US liq. exec. oil)	is	0.12	m^3
1 barrel (oil)	is	0.16	m^3
1 ft^3	is	0.028	m^3
1 gal (US)	is	3.79	dm^3
1 in^3	is	16.4	cm^3
1 oz (US, liquid)	is	29.6	cm^3
1 quart (dry)	is	1.101	dm^3
1 quart (US, liquid)	is	0.946	dm^3
1 $yard^3$	is	0.765	m^3

Weight – See mass or force. For specific weight see density, specific force of gravity, or specific gravity.

Kg* ≐ kg force, sometimes written also as kp.

Use of this Table:

1) Converting to SI units: Multiply the known value by the equivalent.
   Example: Flow of 15 lbm/min. How much is it in g/s?

   Since 1 lbm/min is 7.56 g/s,
   15 lbm/min is 15 X 7.56 = 113.4 g/s
2) Converting to U.S. units: Divide the known value by the equivalent.

(continued on page 56)

SI UNITS – MEASUREMENTS . . .
(continued from page 52)

Example: Flow of 15 g/s. How much is it in lbm/min?

Since 1 lbm/min is 7.56 g/s,
15 g/s is $15 \div 7.56 = 1.98$ lbm/min

3) Converting when the x is in the formula: Place the known value for the x.

Example: Fuel consumption of 20 liter/100 km. How much is it in km/dm^3?

Since x liter/100 km is 100/x km/dm^3
20 liter/100 km is $100/20 = 5$ km/dm^3

Rounding Off Converted Numbers

One frequently encounters complicated, beyond-the-decimal point "accurate" conversions. Following are typical cases indicating practical considerations one must apply when converting.

Torque – Torque values, when they refer to fasteners, are inherently inaccurate. They are usually rounded off to a simple number within 20% of the nominal value. Therefore, the data in N•m will seldom need to be expressed in numbers more precise than rounded off to the nearest 5 N•m or a unit value.

Example: 15-18 ft-lb (20-25 N•m)
not 20.3–24.4 N•m
50–60 in-lb (6-7 N•m)
not 5.7–6.8 N•m

For very small values, no greater precision than 0.5 N is needed.

Example: 10–1 in-lb (1–1.5 N•m)
not 1.13–1.7 N•m

Dimension – A statement that something is 20 inches long may mean a length of between 19 and 21 inches if it is a piece of firewood or 20.000 inches if it is a part of a machine. Similarly, 2.625 inches may mean a length of between 2½ to 2¾ inches or exactly 2.625 inches. The knowledge of application and circumstances involved in making the measurement is needed to determine conversion precision. The 20 inches may correctly be converted to both ½ m and 508.00 mm, the choice depending on the origin and purpose of the information.

TECHNICAL CALENDAR

SEPTEMBER 16-18
GEAR NOISE SEMINAR—Ohio State University.
This course will cover general noise measurements and analysis, causes of gear noise, gear noise reduction techniques, dynamic modeling, gear noise signal analysis and modal analysis of gear boxes. For further information, contact Mr. Richard D. Frasher, Director of Continuing Education, College of Engineering, 2070 Neil Avenue, Columbus, OH 43210. (614) 292-8143.

OCTOBER 4-6
AGMA – GEAR EXPO '87
Cincinnati Convention Center
Cincinnati, OH

OCTOBER 5-7
AGMA – FALL TECHNICAL MEETING
Hyatt Regency Cincinnati
Cincinnati, OH

For further information contact: AGMA 1500 King St., Suite 201, Alexandria, VA 22314 (703) 684-0211.

OCTOBER 7-9
COMPUTER-AIDED GEAR DESIGN PROGRAM
Wisconsin Center, Madison, WI
The University of Wisconsin-Milwaukee presents a three-day seminar for engineers designing and specifying gears or gear drives. It will provide a frame work in which the student may develop a computer-aided design system for his or her individual needs. Basics of both gear design and use of microcomputers will be covered. For more information, contact John M. Leaman, Center for Continuing Engineering Education, Univ. of Wisconsin-Milwaukee, 929 North Sixth Street, Milwaukee, WI 53203. (414) 227-3110.

NOVEMBER 17-19
SME GEAR PROCESSING & MANUFACTURING CLINIC
Michigan Inn, Southfield, MI
Three days of presentations and discussions. Topics to be covered include gear finishing, hardening, broaching, grinding, shaping, inspection and chart evaluation, brush finishing and deburring, hobbing and hob design, choice of materials for cutting tools and shaper cutter design. Tuesday evening Nov. 17, will feature tabletop exhibits of the latest gearing products. For more information about attendance of exhibition space, contact Joe Franchini at SME, One SME Drive, P.O. Box 930, Dearborn, MI, 48121. (313) 271-1500, ext. 394.

CALL FOR PAPERS

ASME 5TH INTERNATIONAL POWER TRANSMISSION AND GEARING CONFERENCE

Deadline for submissions for this spring, 1989, conference is **December 31, 1987.** For more information contact: Donald L. Borden, P.O. Box 502, Elm Grove, WI 53122. (414) 784-9363.