

BRITISH GEAR ASSOCIATION

The British Gear Association (BGA) is a trade association that promotes the technical and commercial interests of manufacturers, distributors, academics and others involved in the Power Transmissions Industry in the United Kingdom.

The Association speaks with authority on behalf of the industry both nationally and internationally and its ability to help companies and individuals involved in the industry is widely recognised by government, the media and industry. The Association is well represented on British and International Standard Committees and provides the Chair of the British Standards Institution's MCE/5 Committee on Gearing.

The British Gear Association works tirelessly on behalf of its members, promoting their interests and concerns of members to the government, the media and other trade bodies. Join the British Gear Association to access the support of not just our permanent team, but also of your peers. Becoming a Member of the BGA allows you to access the accumulated knowledge and experience of the individuals and groups within it. Members contribute to specialist forums promoting discussion and problem solving around gearing topics.

MEMBERSHIP BENEFITS

Here are just a few benefits for you to consider:

- Free Online Training
- Discounted rates on Knowledge Transfer Seminars and other events
- Access to Research Projects and Special Interest Groups (SIGS)
- Free access to BGA Standards Library Online
- View and download technical publications
- Advice on standards
- Create a company listing and promote your company at a Focus Session
- Submit your news and events on our website
- Networking with other members
- UK Gear Statistics
- Advertise your vacancies
- Free STEM kit for school engagement





NETWORKING

The British Gear Association hold regular technical and commercial Networking events across the UK.

At our events there is plenty of opportunity to **network with the leading Gear companies, manufacturers, distributors and academics** in the UK.

Join us at one of our events for a chance to share prospects, discuss challenges and promote your interests to likeminded people.



TECHNICAL SUPPORT

Whether you are looking for some technical expertise to help you with a specific problem or are simply looking for a second opinion from an industry expert, the BGA can help.

The BGA Membership connects you directly to a Gear Expert who is there to help you with any gear related questions, or quandaries. No matter how big or small your question the BGA Technical team are waiting for your call.

The BGA Technical Research Management Team have ISO Standards experts and they are available to help you understand and navigate ISO Standards.

Special Interest Groups are a semi-structured group of BGA members with a common interest in a specific area of technology. The groups provide a forum for members to discuss common problems or topic areas to a mutual benefit. The outputs for these groups can be to develop more structured research opportunities or to simply address specific topics for the moment in a particular subject area.

Our technical expertise includes but is not limited to: Gearing and mechanical power transmission technologies in aerospace, agriculture, automotive, rail, renewables, marine, minerals, energy and water.



STANDARDS

BGA Standards Library

British Standards Institute (BSI) work with ISO and other standards groups to ensure the standards available in the UK are fit for purpose and reflect current and best working practices. A quick check on the BSI website shows there are over 80 standards documents that relate to gears. While some of these are old and maintained for historical purposes, many are new or recently revised to reflect the changing needs of our industry.

We have curated a library of 25 essential Gear Standards through BSI and they are available now completely free of charge to BGA Members via the BGA website—saving you up to £6,500

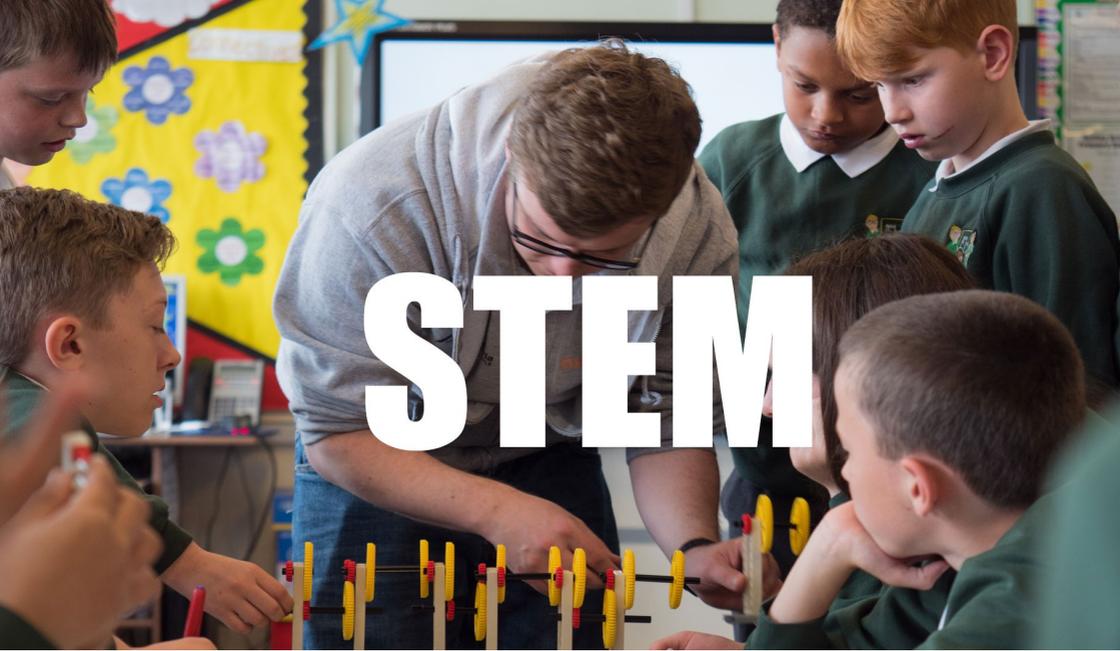
The Standards library is kept completely up to date so you will always be working with the latest publication.

BGA Standards Work

The standards are maintained by a technical committee of volunteers who offer their services free of charge to BSI and ISO to ensure the standards are fit for purpose. There is a perception that these standards 'are set in stone' and do not change but when problems are noted with implementation of existing standards, these are reviewed and addressed by the relevant technical committee. Similarly, as technology and technical understanding develops, standards are revised but the technical committees must be mindful that changes also incur costs for industry and thus a great deal of care is needed to minimise this while maximising the benefits.

The BSI Technical Committee MCE 5 is responsible for gears. A series of working groups or panels covering a range of technical fields support work undertaken by ISO.





STEM

A significant remit of the British Gear Association is to ensure the future of the Gearing Industry in the UK.

In accordance with this responsibility the BGA are dedicated to helping to bring through the next generation of Engineers in the UK.

Our initiatives start in primary school and extend to postgraduate MSc level. Primary School children engage in our STEM PRIMARY GEARS package, both undergraduate (HNC/HND/BEng/BSc) and postgraduate (MEng/MSc) students are supported through the UNIVERSITY FORMULA STUDENT SPONSORSHIP and the JOINT BGA/IMECHE STUDENT PRIZE.

Joint ImechE Student Prize

The joint BGA IMechE student prize has been established since 2000 and is considered one of the most prestigious Student prizes in the field of Mechanical Engineering.

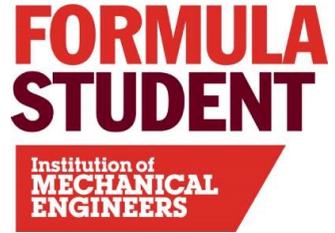
The goal of the prize is to encourage and support the growth of the next generation of UK engineers.

The £400 prize is awarded for the best Final Year Project on any topic broadly related to the field of mechanical power transmissions.

Formula Student Sponsorship

The BGA are proud to sponsor BGA Members' Formula Student teams.

Formula Student (FS) is Europe's most established educational engineering competition, which celebrated its 25th Anniversary in 2023.



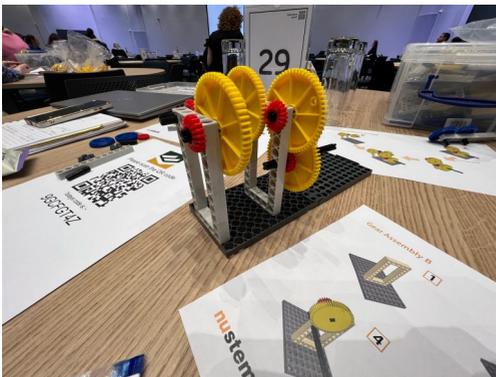
Backed by industry and high-profile engineers such as Patron, Ross Brawn OBE, the competition aims to develop enterprising and innovative young engineers and encourage more young people to take up a career in engineering.

Primary Gears Workshop

The BGA have worked with NUSTEM at Northumbria University to develop a workshop to be delivered to children supporting the Primary National Curriculum for gears pulleys and levers.

This is a great opportunity for **engineers and technicians to build links with their local communities**, develop their communication skills and make a positive contribution to children's engineering knowledge.

This kit is available free of charge to BGA Members .



RESEARCH FUNDING

One way the BGA provides technical support to its members is by facilitating and encouraging research. If we are not improving and developing our capability, then relative to the rest of the sector worldwide, we would be sliding backwards.

The BGA is initiating several small projects that may provide the ideas that generate a whole new technology stream or simply improve our members' competitiveness. These projects may initiate collaborative research projects between Industry and Academia or deliver something useful on their own. The results from these projects will be presented to the BGA membership by report or presentation.

The project proposals can be made by any BGA member. Proposals are reviewed by the Technical and Research Management Committee and if they accepted, £5k to 10K of BGA funds will be made available to deliver the project.

If you have any questions about the BGA's research or would simply like to find out more about previous research projects, then please get in touch today.





TRAINING

The British Gear Association (BGA) are the leading providers of gear related training in the UK and Europe. All BGA training is developed and delivered by Gear experts from Academia and Industry.

Our Training Programme encompasses introductory classes to more in-depth specialist training. We have all of your gear training needs covered.

Our courses are suitable for all sections of the gearing world. From students and apprentices starting out in their careers to experts wanting to hone their skills or get up to date with the latest developments. Our training is CPD Accredited, considered Industry Standard and delivered flexibly to suit a variety of business needs

Online training is completely free to BGA Members.

If you would like to register for any of our essential gear training please contact the BGA office admin@bga.org.uk or register online at www.bga.org.uk.

GEAR FOUNDATION 1

These introductory courses are suitable for anyone joining the gear industry. This introduction to Gears is beneficial to staff directly working with gears and also wider departments, HR/Sales etc to ensure every member of your organisation has a broad understanding of gears.

- Gear Fundamentals
- Noise & Load
- Gear Manufacture
- Heat Treatment and Gear Measurement

GEAR GEOMETRY

Gear geometry is thought to be complex and often considered a 'black art'. This short on-line session will dispel this myth and provide delegates with a basic knowledge of how gears work and cylindrical gear geometry. No prior gear knowledge is required.

It is applicable to gear designers, manufacturing staff, machine operators, inspectors and those who are new to the gear industry and want to understand what all the fuss is about.

- CYLINDRICAL GEAR GEOMETRY PART 1- How involute gears work
- CYLINDRICAL GEAR GEOMETRY PART 2- An Introduction to BS ISO 21771:2007
- CYLINDRICAL GEAR GEOMETRY PART 3- Gear pairs and their related gear geometry
- CYLINDRICAL GEAR GEOMETRY PART 4- Performance related gear geometry

GEAR FOUNDATION 2

These introductory courses are suitable for anyone joining the gear industry. This introduction to Gears is beneficial to staff directly working with gears and also wider departments, HR/Sales etc to ensure every member of your organisation has a broad understanding of gears.

- Gear System Arrangements - Design and selection
- Gearbox Fundamentals - Design requirements and essential components
- Gear Lubrication Introduction

GEAR CUTTING AND MEASUREMENT

The BGA Introduction to Gear Cutting and Measurement course is essential for engineers who want to broaden their understanding first principals of gear design and cutting. Delegates will learn first principals of gearing and gain practical experience using our Maxicut 2A shaping machine and Sykes H150 hobbing machine. These manual machines will allow delegates to see the principals of gear design in reality giving a broader understanding of how the gear tools work.

- Understand basic spur and helical gear theory and terminology
- Carry out basic calculations for the manufacture and measurement of gears
- Understand how spur and helical gears are cut by hobbing and shaping
- Gain practical experience in setting up, producing and measuring gears made by hobbing & shaping
- Basic involute gear theory, terms and definitions for spur and helical gears including:
 - Gear terms and definitions
 - Introduction to the involute form and its construction/tables

Practical work on the measurement of gears including calculations on the following:

- Chordal tooth settings for gear tooth Vernier. Chord settings to gear tooth Vernier
- Base tangent micrometer settings
- Distance over rollers measurement
- Basic principles of gear hobbing and shaping
- Selection of index and feed change gears
- Setting up and producing spur & helical gears by hobbing and shaping using a *Maxicut 2A* shaping machine and *Sykes H150* hobbing machine

GEAR MEASUREMENT

This course is a series of on-line training sessions that will introduce delegates to the key skills and knowledge needed to measure and interpret gear measurement results. No prior gear knowledge is required but those who are new to gear technology would benefit from participating in the BGA Gear Foundation and Introduction to Gear Geometry courses.

This seminar will cover:

- Cylindrical gear geometry measurement Part 1- Introduction to measurement methods and radial composite (double flank) measurement.

- Cylindrical gear geometry measurement Part 2- Introduction to tangential composite (single flank) measurement and tooth thickness measurement
- Cylindrical gear geometry measurement Part 3- Introduction to single element (helix, profile, pitch and runout) measurement.
- Cylindrical gear geometry measurement Part 4- Introduction to single element (helix, profile, pitch and runout) tolerance standards and how to interpret results to a standard.
- Cylindrical gear geometry measurement Part 5- Introduction to gear measuring machine calibration.

HEAT TREATMENT OF GEAR STEELS

This course will present the heat treatment of gear steels assuming minimal prior knowledge. After an introduction to the basic metallurgical concepts and key principles, the enhancement of surface properties by carburising and induction hardening will be explained. The properties imparted by, and the consequences and problems of the chosen process with reference to material selection, distortion and growth will be covered with the aid of case histories.

- Introduction to steel heat treatment – metallurgical principles; hardening & tempering
- Carburising
- Introduction to nitriding, nitro-carburising & other surface treatments
- Laser & Electron Beam Hardening
- Induction & flame hardening
- Problem solving – low/high hardness; case-depth
- Controlling distortion



GEAR WEAR AND FAILURE RECOGNITION

The seminar gives delegates an insight into the appearance and underlying causes of gear failure modes. It provides gear manufacturers and users with the necessary skills to examine, assess and recognise common gear failure modes.

- How gears work and how they fail and wear
- Failure recognition strategy
- An introduction to the common investigation methods and equipment used to establish the root cause of a failure
- An introduction to the ISO 10825 failure modes standard and supporting ISO standards
- Case studies
- Failure recognition- a chance to test your failure recognition skills with 20 failed gear samples

GEAR NOISE AND TRANSMISSION ERROR

This seminar is aimed at both gear users and gear manufacturers. The course will examine the basic causes of gear noise and the path from initial gear design and manufacturing errors to the final noise generation.

Gear Design for Low Noise

- TE and spur gears ,TE and helical gears
- The relation of TE to contact ratios and the concept of integer contact ratio
- Effect of misalignment on tooth contact
- Practical approaches to designing gears for low TE
- TE in planetary gears (theory of factorising and non-factorising)

Noise Signals

- Tooth passing frequencies
- Gear pairs
- Planetary gears
- Run out ; generation of side bands
- Ghost frequencies and their origin

Noise measurement

The practical aspects of noise measurement will be considered where in order to correctly diagnose the cause/source of the noise.

GEAR STRESS ANALYSIS

This is part of a series of short on-line training sessions that will introduce delegates to the key skills and knowledge needed to perform gear contact and bending fatigue stress analysis. The course covers the application of ISO 6336 bending and contact stress analysis methods. No prior gear knowledge is required but those who are new to gear technology would benefit from participating in the BGA Gear Foundation and Introduction to Gear Geometry online courses.

It is applicable to gear designers, users of ISO 6336 and those who are involved with gear manufacture and want to understand why designers use tight tolerances and high grade materials.

- Introduction to gear loads, failure modes and geometry
- Introduction to gear load modifying factors and permissible stresses for contact and bending fatigue
- Introduction to gear contact stress and bending stress key influence factors
- Introduction to using ISO 6336 and optimising bending and contact safety factors

GEAR NOISE DATA INTERPRETATION AND DIAGNOSTICS

Noise and vibrations are omnipresent, and while they may seem straightforward to interpret in some scenarios, industrial applications often introduce complexities that require a deeper understanding. This seminar explores the theoretical foundations of noise and vibrations, their sources, modes of transmission, and their implications for both systems and their surroundings. This seminar is designed to share the knowledge and tools necessary to interpret and diagnose noise and vibrations effectively in various industrial applications.

- Principles of noise and vibrations
- Measurement techniques
- Understanding Gearbox Noise and vibrations
- Gear geometry, microgeometry and Transmission Error
- Gear design optimisation
- Rattle and Whine in gears
- Modal analysis and Modal shapes
- Data analysis and signal processing- time domain plots, FRF, FFT, Hilbert Transforms
- Case studies from a versatile selection of industrial applications

GEARBOX SYSTEMS PROBLEMS & SOLUTIONS

Many reliability and wear problems in transmission systems are not directly associated with the design of the components themselves but are the result of system dynamics: starting and transient torques, self-excited vibration and the dynamics of the motor or engine and of the driven machine. Particular characteristics of bearings, couplings and gearbox mounting can also significantly affect system performance. Typical problems and solutions are discussed and instrumentation for troubleshooting noise, bearing failures, vibrations and in-service load measurement demonstrated.

- Tackling Unexplained Bearing and Gear Element Failures
- The Dynamics of Gearbox Systems
- Gearbox Noise and Vibration
- Problem Solving using State of the Art Data Acquisition & Analysis Techniques
- Wind Turbine Gearboxes: Type Testing, Instrumentation & Early Stage Troubleshooting
- Gear Alignment Instrumentation (KH β , KY)
- In-Service Unattended Load (Torque) Data Collection Techniques
- Case Studies in Rail, Marine Propulsion, Renewables, Automotive and Heavy Industries
- State of Art Condition Monitoring Techniques

COURSES PHASE 3:

DESIGN OF EXPERIMENTS

Properly designed experiments will improve understanding of the Cause and Effect relationship in any process. Predictive knowledge of the process, in order to improve it. Control process costs, while meeting or exceeding customer requirements.

- Background to DOE in understanding the cause and effect relationship
- Understanding data types, and the wide range of experimental tools.
- Planning an experiment (including gear measurement considerations)
- Determine if any factor or combination of factors is significant
- Screening trials and observations
- Replication and Repetition
- Statistical control and stability
- Analysis of Results via ANOVA and define prediction equations
- Process optimisation to reduce costs
- Case studies

INTRODUCTION TO ROLLING ELEMENT BEARINGS

Bearings are an integral part of all mechanical power transmissions and rolling element bearings are often the most accurate component on the transmission. A good understanding of how they work is essential to those involved in transmission design, manufacture and assembly activities. We will be examining both as run and damaged bearings which illustrate common failure modes.

- How rolling element bearings work and the history of their development
- Common radial and thrust bearing types and their application
- Benefits and limitations of each type of bearing
- Lubrication considerations
- Calculation of bearing loads caused by the gears and discuss good design practice
- Common bearing failure modes and an introduction to BS ISO 15243:2017 – Rolling bearings — Damage and failures — Terms, characteristics and causes
- Basic bearing life calculation to BS ISO 281:2007 – Rolling bearings — Dynamic load ratings and rating life, for L10 life calculation and the modified life calculation L_{mn} considering endurance limit, lubrication and lubricant contamination. How do you use them?
- Miners sum cumulative damage analysis methods to account for varying load conditions
- Examination of failed bearings and typical witness marks on bearings in service

INTRODUCTION TO BEVEL GEARS

This “Introduction to Bevel Gears” training session is an invaluable resource for anyone eager to deepen their understanding of bevel gear technology. Participants will have the opportunity to dive into the intricacies of bevel gears during this in-depth online course.

- Bevel Gear types , applications and classifications
- Fundamentals of Geometry
- Offset, Hand of Spiral & Direction of Rotation
- Face Milling – Face Hobbing Comparison
- Basics of the Continuous Indexing System
- Contact Pattern Development
- Tooth Contact Analysis
- Process of Design
- Calculation of Load Capacity
- Production Methods
- Measurement, Checking, and Assembly of Bevel Gears
- Failure Modes
- Optimisation



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