

me 719 vibration testing wright state university Online PDF

ME 719 Vibration Testing Wright State University

Vibration testing plays a crucial role in the field of mechanical engineering, especially in the context of aerospace, automotive, civil engineering, and structural health monitoring. At Wright State University, the ME 719 Vibration Testing course offers students an in-depth understanding of vibration analysis, experimental techniques, and testing methodologies. This comprehensive guide explores the key aspects of ME 719 Vibration Testing at Wright State University, including course overview, objectives, laboratory components, significance in engineering applications, and career prospects for students specializing in vibration testing.

Understanding ME 719 Vibration Testing at Wright State University

Course Overview

ME 719 Vibration Testing is a graduate-level course designed to equip students with both theoretical knowledge and practical skills necessary for conducting vibration analysis and testing. The course integrates classical vibration theory with hands-on experimental techniques, enabling students to analyze complex vibration phenomena in real-world systems.

Some key components of the course include:

- Fundamentals of vibration theory
- Dynamic response analysis
- Experimental modal analysis
- Signal processing and data acquisition
- Vibration testing procedures and standards
- Data interpretation and troubleshooting

The course typically combines lectures, laboratory sessions, and project work to provide a well-rounded educational experience.

Course Objectives

The primary objectives of ME 719 Vibration Testing at Wright State University are to:

- Develop a deep understanding of vibration phenomena in mechanical systems
- Teach students how to design and perform vibration tests
- Enable students to interpret data accurately and apply findings to engineering problems
- Introduce state-of-the-art vibration testing equipment and software
- Prepare students for careers in aerospace, automotive, civil, and manufacturing industries

Laboratory Components and Hands-on Experience

Vibration Test Equipment and Instruments

The laboratory sessions in ME 719 utilize advanced equipment to simulate and analyze vibrations. Key instruments include:

- Shakers and exciters for inducing vibrations
- Accelerometers and strain gauges for measuring responses
- Data acquisition systems for capturing signals
- Signal analyzers and software for data processing

Students learn how to set up experiments, calibrate equipment, and ensure safety during testing procedures.

Typical Laboratory Activities

Some practical activities students undertake include:

- Conducting free vibration and forced vibration tests
- Performing modal analysis to identify natural frequencies and mode shapes
- Analyzing damping ratios and response amplitudes
- Testing structural components under simulated vibration loads
- Validating theoretical models through experimental data

Project Work and Case Studies

Students often engage in comprehensive projects that involve designing a vibration testing plan for a specific system, executing tests, analyzing data, and presenting findings. Case studies of real-world vibration issues?such as aircraft component fatigue, bridge vibrations, or machine resonance?are incorporated to enhance understanding.

The Significance of Vibration Testing in Engineering

Applications in Various Industries

Vibration testing is vital across multiple sectors, including:

- Aerospace: Ensuring aircraft components withstand in-flight vibrations
- Automotive: Improving vehicle ride quality and durability
- Civil Engineering: Monitoring structural health of bridges and buildings
- Manufacturing: Quality control of machinery and equipment
- Energy: Vibration analysis of turbines and generators

Benefits of Vibration Testing

Implementing vibration testing offers numerous advantages:

- Identifies potential failure points before catastrophic failure
- Validates design models and simulations
- Enhances safety and reliability of mechanical systems
- Reduces maintenance costs through predictive maintenance
- Contributes to innovations in material and structural design

Regulatory Standards and Best Practices

The course emphasizes adherence to industry standards such as ISO 2041 (Mechanical vibration and shock?Vocabulary), ASTM standards, and military specifications. Understanding these standards ensures that testing procedures are consistent, reliable, and compliant with regulatory requirements.

Career Opportunities for Graduates of ME 719 Vibration Testing

Potential Job Roles

Graduates with expertise in vibration testing are well-positioned for careers in:

- Vibration Analyst
- Test Engineer
- Structural Dynamics Specialist
- Condition Monitoring Engineer
- Research Scientist

- Quality Assurance Engineer

Industries Hiring Vibration Testing Experts

Industries actively seeking professionals include:

- Aerospace and Defense
- Automotive manufacturing
- Civil and Structural Engineering
- Power Generation and Renewable Energy
- Manufacturing and Industrial Equipment
- Research and Development institutions

Skills Gained and Their Value

Students develop critical skills such as:

- Proficiency with vibration testing hardware and software
- Data analysis and interpretation
- Problem-solving in dynamic systems
- Knowledge of mechanical design and materials
- Ability to communicate technical findings effectively

These skills are highly valued in the job market and contribute to career advancement.

Why Choose Wright State University for Vibration Testing Education?

State-of-the-Art Facilities

Wright State University boasts modern laboratories equipped with the latest vibration testing and analysis equipment, providing students with practical experience aligned with industry standards.

Expert Faculty and Industry Connections

The course is taught by faculty with extensive research backgrounds and industry experience. The university maintains partnerships with local industries and research institutions, offering students internship and employment opportunities.

Research Opportunities

Graduate students can participate in ongoing research projects related to vibration suppression, structural health monitoring, and innovative testing methodologies, fostering academic growth and professional development.

Preparing for the Future with ME 719 Vibration Testing

Studying vibration testing at Wright State University prepares students for the ever-evolving challenges in mechanical engineering. The combination of theoretical knowledge and hands-on experience equips graduates to innovate, improve safety, and optimize performance in various engineering systems.

Whether pursuing careers in research, industry, or academia, students gain a competitive edge through this specialized course, positioning them as experts capable of tackling complex vibration-related issues.

Conclusion

In summary, ME 719 Vibration Testing at Wright State University offers a comprehensive education in the analysis, testing, and application of vibration principles. Through rigorous coursework, advanced laboratory experiences, and industry engagement, students acquire the skills necessary to excel in fields that demand precise vibration analysis and testing expertise. As vibrations influence the safety, reliability, and performance of mechanical systems, expertise gained from this course is invaluable for future engineers aiming to make significant contributions to technology and infrastructure development.

For aspiring mechanical engineers, Wright State's ME 719 provides a solid foundation in vibration testing—an essential discipline in modern engineering—opening doors to diverse career opportunities and innovative research endeavors.

ME 719 Vibration Testing Wright State University: An In-Depth Investigation

Vibration testing plays a pivotal role in engineering disciplines, particularly in aerospace, automotive, civil, and mechanical engineering, where structural integrity and reliability are paramount. At the forefront of cutting-edge research and practical application in this domain is the ME 719 Vibration Testing course offered at Wright State University. This comprehensive investigation explores the course's curriculum, pedagogical approach, laboratory facilities, research contributions, industry collaborations, and its impact on students and the broader engineering community.

Overview of ME 719 Vibration Testing at Wright State University

The ME 719 Vibration Testing course is a graduate-level offering within Wright State University's

College of Engineering and Computer Science. Designed for students specializing in mechanical, aerospace, and civil engineering, the course aims to equip learners with the theoretical foundation and practical skills necessary to conduct, analyze, and interpret vibration tests on various structures and mechanical components.

The course emphasizes the integration of classical vibration theory with modern experimental techniques, fostering a comprehensive understanding of dynamic behavior, modal analysis, and system identification. Through a combination of lectures, hands-on laboratory work, and research projects, students develop the expertise needed to address real-world vibration challenges.

Curriculum and Learning Objectives

The ME 719 Vibration Testing curriculum is structured to progressively build knowledge, starting from fundamental principles to advanced experimental methodologies. Key topics include:

- Fundamentals of Vibrations: Basic concepts, equations of motion, free and forced vibrations
- Modal Analysis: Techniques for identifying natural frequencies, damping ratios, and mode shapes
- Vibration Measurement Techniques:
 - Accelerometers and velocity sensors
 - Strain gauges
 - Laser Doppler vibrometry
- Vibration Testing Procedures:
 - Setup and calibration
 - Excitation methods (impact, shaker, environmental)
 - Data acquisition systems
- Signal Processing and Data Analysis:
 - Fourier transforms
 - Power spectral density
 - Curve fitting and modal parameter extraction
- Finite Element Modeling and Correlation with Experimental Data
- Fatigue and Durability Testing
- Applications in Structural Health Monitoring and Condition Assessment

Learning objectives focus on enabling students to:

- Design and implement vibration testing protocols
- Operate sophisticated measurement equipment
- Analyze complex vibration data accurately

- Correlate experimental results with theoretical models
- Apply vibration testing insights to engineer safer, more reliable structures

Laboratory Facilities and Equipment

A cornerstone of the ME 719 Vibration Testing course is its state-of-the-art laboratory facilities, which provide students with hands-on experience. Wright State University has invested significantly in equipment that mirrors industry standards:

- Shaker Tables: Electrodynamic shakers capable of simulating a wide range of vibrational environments
- Data Acquisition Systems: High-speed digital recorders with multi-channel inputs
- Sensors and Transducers:
 - Piezoelectric accelerometers
 - Laser Doppler vibrometers
 - Strain gauges and rosettes
- Signal Processing Software:
 - MATLAB and LabVIEW for data analysis and visualization
 - Modal analysis toolkits
- Structural Test Fixtures: Customizable setups for testing beams, plates, and complex assemblies

The laboratory's design encourages experiential learning, where students undertake complete vibration testing projects from experimental setup to data interpretation mimicking real-world engineering scenarios.

Research Contributions and Industry Collaboration

Wright State University's commitment to advancing vibration testing is exemplified by its active research initiatives and partnerships with industry leaders. The ME 719 course often integrates ongoing research projects, providing students with exposure to pioneering work in the field.

Research Focus Areas Include:

- Development of improved modal analysis algorithms
- Structural health monitoring using vibration signatures
- Vibration-based damage detection techniques
- Vibration suppression and control strategies
- Innovations in sensor technology and data acquisition

Collaborations with aerospace firms, automotive manufacturers, and civil engineering agencies enable faculty and students to work on projects that have tangible industry impact. These partnerships often lead to joint publications, patents, and technological innovations, positioning Wright State as a notable contributor to vibration testing advancements.

Impact on Student Development and Career Readiness

Participation in ME 719 Vibration Testing offers students a competitive edge in their engineering careers. The practical laboratory experience, combined with theoretical rigor, prepares graduates for roles in research and development, quality assurance, structural analysis, and consulting.

Key benefits include:

- Mastery of vibration measurement and analysis techniques
- Experience with industry-standard equipment and software
- Ability to interpret complex data and make engineering decisions
- Exposure to multidisciplinary applications
- Enhanced problem-solving and critical thinking skills

Alumni of the course have secured positions in leading aerospace companies, civil infrastructure firms, and research institutions, highlighting the program's effectiveness in fostering industry-ready professionals.

Challenges and Opportunities for Future Development

Despite its strengths, the ME 719 Vibration Testing course faces ongoing challenges and opportunities:

- **Technological Advancements:** Incorporating emerging technologies such as machine learning for data analysis, wireless sensors, and remote testing capabilities.
- **Curriculum Updates:** Ensuring content remains aligned with industry standards and research trends.
- **Interdisciplinary Integration:** Expanding collaborations across departments like electrical engineering and computer science to include sensor networks and signal processing innovations.
- **Accessibility and Cost:** Balancing the expense of high-end equipment with the need for broad student access.

Future developments could include virtual reality simulations for initial testing, cloud-based data sharing platforms, and increased emphasis on sustainable vibration mitigation solutions.

Conclusion

The ME 719 Vibration Testing course at Wright State University exemplifies a comprehensive and forward-looking approach to engineering education in dynamic systems analysis. Through a rigorous curriculum, cutting-edge laboratory facilities, and active research partnerships, the program effectively prepares students to meet the complex vibration challenges faced across multiple industries.

As technology advances and the demand for resilient, reliable structures grows, programs like ME 719 will continue to be vital. Wright State University's investment in this field not only enhances student competence but also contributes significantly to the broader engineering community's understanding and application of vibration testing methodologies.

In summary, ME 719 Vibration Testing Wright State University stands as a model of integrating academic excellence with practical application, fostering innovation, and advancing the state of the art in vibration analysis. Its continued development promises to sustain its reputation as a leader in engineering education and research.

Question What is the focus of the ME 719 Vibration Testing course at Wright State University? The ME 719 course focuses on advanced vibration testing techniques, including experimental methods, data analysis, and applications in engineering systems. How does ME 719 prepare students for careers in vibration analysis? The course provides hands-on experience with vibration testing equipment, data acquisition, and interpretation, equipping students with practical skills for industry and research roles. Are there any recent research projects associated with ME 719 at Wright State University? Yes, recent projects include studies on aircraft component vibrations, structural health monitoring, and the development of new vibration testing methodologies. What laboratory equipment is used in ME 719 vibration testing courses? Students typically work with modal shakers, accelerometers, data acquisition systems, and analysis software such as MATLAB and MEscape. Is ME 719 suitable for students interested in aerospace or mechanical engineering? Absolutely, the course is highly relevant for students pursuing careers in aerospace, mechanical, or civil engineering, especially those focusing on structural dynamics and testing. How does Wright State University incorporate industry standards into ME 719? The course integrates industry-standard testing procedures and protocols, often including case studies from aerospace and manufacturing sectors. Can students participate in vibration testing research projects at Wright State University? Yes, students are encouraged to engage in research projects, often collaborating with faculty on cutting-edge vibration analysis and testing studies. What are the career prospects after completing ME 719 vibration testing at Wright State University? Graduates can pursue careers in aerospace, automotive, manufacturing, structural health monitoring, and research roles involving vibration analysis and testing. Are there any upcoming workshops or seminars related to vibration testing at Wright State University? Wright State University regularly hosts workshops and seminars on vibration testing technologies, which are open to students and industry professionals for

networking and skill development.

Related keywords: vibration testing, ME 719, Wright State University, mechanical engineering, modal analysis, dynamic testing, structural analysis, experimental mechanics, laboratory course, engineering research

Kisii University 2013 Graduation

kisii university 2013 graduation marked a significant milestone in the academic journey of numerous students who had dedicated years of hard work and perseverance to achieve their dreams. As one of Kenya's reputable institutions of higher learning, Kisii University has continually emphasized academic excellence, community service, and personal development. The 2013 graduation ceremony was particularly memorable, characterized by inspiring speeches, proud families, and the celebration of accomplishments across various disciplines. This article provides a comprehensive overview of the Kisii University 2013 graduation, exploring its significance, the ceremony details, notable graduates, and the impact on the university community.

Overview of Kisii University

Before delving into the specifics of the 2013 graduation, it is essential to understand the institution's background and its role in higher education in Kenya.

History and Establishment

Kisii University, located in Kisii County in southwestern Kenya, evolved from the University of Nairobi's Kisii Campus. It gained university status in 2010, becoming a full-fledged university committed to providing quality education, research, and community engagement. The university's mission revolves around fostering innovation, leadership, and holistic development among students.

Academic Programs and Faculties

Kisii University offers a diverse range of undergraduate and postgraduate programs across various faculties, including:

- Faculty of Education
- Faculty of Business and Economics
- Faculty of Science and Technology

- Faculty of Health Sciences
- Faculty of Arts and Social Sciences

This broad academic portfolio attracts students from different regions, fostering a vibrant campus culture.

The 2013 Graduation Ceremony

Date and Venue

The Kisii University 2013 graduation took place on a memorable date?likely in late 2013, typically around December?at the university?s main campus. The event was attended by students, faculty, family members, government officials, and distinguished guests, all gathered to celebrate academic achievements.

Significance of the 2013 Graduation

For many graduates, this ceremony was the culmination of years of effort and sacrifice. It represented not just personal success but also the university?s growth and commitment to producing competent professionals. The 2013 graduation was also a reflection of the university?s expanding reputation and its role in Kenya?s development.

Highlights of the 2013 Graduation

Number of Graduates

In 2013, Kisii University graduated hundreds of students across various disciplines. The exact number varied, but reports indicated that over 1,000 students received their degrees and diplomas during this ceremony, marking a significant increase from previous years.

Academic Excellence and Awards

Outstanding students were recognized for their exemplary performance. Several graduates received academic awards, scholarships, and medals for achieving top honors in their respective fields. These recognitions served to motivate others and uphold a culture of excellence.

Keynote Speeches and Addresses

Prominent figures, including university administrators, government officials, and industry leaders, delivered speeches emphasizing the importance of education, innovation, and service. The keynote address often highlighted Kenya?s development goals and the role of graduates in national

progress.

Notable Graduates and Their Achievements

Prominent Alumni

While specific names from the 2013 graduation may not be publicly documented, many graduates from this cohort have gone on to excel in various sectors such as education, healthcare, business, and government. Some have become community leaders, entrepreneurs, or academics contributing to societal development.

Success Stories

- Entrepreneurs: Several 2013 graduates established startups in Kisii and beyond, contributing to local economies.
- Public Servants: Others joined government agencies, bringing fresh ideas and youthful energy to public service.
- Academicians: Some pursued postgraduate studies and academia, further enhancing Kisii University's reputation.

Impact of the 2013 Graduation on Kisii University

Institutional Growth

The successful graduation of a large cohort showcased the university's capacity to deliver quality education and manage large-scale ceremonies. It helped boost the institution's profile both locally and nationally.

Community and Economic Development

Graduates from 2013 have played vital roles in their communities, contributing to social development, education, health, and entrepreneurship. Their achievements reflect positively on Kisii University's mission to produce socially responsible graduates.

Enhanced Reputation and Future Prospects

The 2013 graduation reinforced Kisii University's reputation as an institution committed to academic excellence. It paved the way for future expansions, new programs, and increased student enrollment.

Post-Graduation Pathways and Opportunities

Employment and Career Development

Many 2013 graduates found employment within Kenya's growing economy. Some entered the public sector, while others ventured into private enterprises or started their own businesses.

Further Education

A significant number of graduates pursued postgraduate studies locally and abroad, enhancing their qualifications and opening doors to advanced career opportunities.

Community Engagement and Impact

Graduates have continued to serve their communities through leadership roles, mentorship programs, and social initiatives, embodying the values instilled during their time at Kisii University.

Conclusion

The Kisii University 2013 graduation remains a landmark event in the university's history, symbolizing achievement, hope, and future potential. It not only celebrated individual success but also highlighted the institution's role in shaping Kenya's future leaders. As graduates from 2013 continue to make their mark across various sectors, their journey underscores the importance of dedication, resilience, and the transformative power of education. For prospective students and alumni alike, the 2013 graduation serves as a reminder of the possibilities that come with perseverance and academic excellence at Kisii University.

Kisii University 2013 Graduation: A Landmark Event in Academic Excellence and Community Development

The Kisii University 2013 graduation marked a pivotal milestone in the institution's history, symbolizing academic achievement, community growth, and the university's rising stature within Kenya's higher education landscape. This graduation ceremony not only celebrated the accomplishments of hundreds of graduates but also reinforced Kisii University's commitment to producing competent professionals who would contribute significantly to national development. In this comprehensive guide, we delve into the significance of the 2013 graduation, explore the event's highlights, and analyze its broader implications for students, faculty, and the community.

Background of Kisii University and Its 2013 Graduation

Kisii University, located in the heart of Kisii County in Kenya, has grown steadily since its

establishment. Originally a constituent college of Moi University, it gained full university status in 2010, making the 2013 graduation one of its early major ceremonies as an independent university. The event was characterized by a sense of pride, progress, and hope for future generations.

The 2013 graduation was held at the university's main grounds, attracting thousands of students, faculty members, family, and dignitaries. It was a moment of celebration for the university's academic community, marking the culmination of years of hard work and dedication.

Significance of the 2013 Graduation for Kisii University

A Milestone in Institution Development

- **Transition to a Full University:** The 2013 graduation underscored Kisii University's transition from a college to an autonomous university, reflecting its growth in size, academic programs, and research capacity.
- **Recognition and Prestige:** The event elevated the university's profile nationally and regionally, attracting prospective students, partnerships, and funding opportunities.
- **Academic Milestone:** Hundreds of students graduated with degrees, diplomas, and certificates across various disciplines, showcasing the university's diverse academic portfolio.

Community and Economic Impact

- **Local Development:** The graduation boosted local businesses, with increased demand for accommodation, catering, transportation, and retail services.
- **Social Impact:** Graduates from this event became vital contributors to the Kisii County economy, health sector, education, and governance sectors, embodying the university's mission to serve community needs.

Highlights of the Kisii University 2013 Graduation Ceremony

Keynote Addresses and Dignitaries

The event was graced by prominent figures including:

- The Minister of Education or his representative
- The university's Vice-Chancellor and senior administrators
- Local government officials
- Representatives from partnering universities and organizations

These speakers emphasized the importance of higher education in national development, innovation, and community service.

Academic Achievements and Awards

- Degrees Conferred: The ceremony saw the graduation of over 2,000 students across various faculties including Education, Business and Economics, Science, Health Sciences, and Social Sciences.
- Special Awards: Outstanding students received awards for academic excellence, leadership, and community service, inspiring peers to pursue excellence.

Unique Features of the 2013 Graduation

- Cultural Displays: Traditional Kisii dances and music were showcased, highlighting local culture.
- Innovative Initiatives: The university announced new programs and partnerships aimed at enhancing research and community engagement.
- Dress Code: Graduates wore academic regalia, with some faculties adopting distinctive colors representing their disciplines.

Academic Programs and Disciplines Celebrated

The 2013 graduation covered a broad spectrum of disciplines, reflecting the university's commitment to comprehensive education:

- Bachelor's Degrees: Education, Business Administration, Economics, Computer Science, Environmental Science, Nursing, and more.
- Diplomas and Certificates: Various technical and vocational programs aimed at skill development.
- Postgraduate Awards: Masters and PhDs in diverse fields, fostering advanced research and specialization.

Notable Graduates and Their Contributions

Many graduates from the 2013 cohort have since made significant impacts in their respective fields:

- Leaders in Education: Some have become teachers, administrators, and policymakers within Kenya.

- Entrepreneurs: Several graduates have started successful businesses, contributing to local employment.
- Health Sector Professionals: Many are working as nurses, doctors, and public health officers across Kenya.
- Researchers and Innovators: Some have pursued further studies or contributed to community-based research projects.

Challenges Faced and Lessons Learned

While the 2013 graduation was largely successful, it also highlighted areas for improvement:

- Capacity Building: The need for increased infrastructure, such as lecture halls and laboratories, to accommodate growing student populations.
- Curriculum Development: Ensuring programs remain relevant to changing industry needs and technological advancements.
- Student Support Services: Enhancing career guidance, counseling, and internship opportunities to better prepare graduates for employment.

The university's leadership acknowledged these challenges and committed to continuous improvement, laying a foundation for subsequent graduations.

Broader Impacts and Future Outlook

The Kisii University 2013 graduation set a precedent for subsequent ceremonies, emphasizing the importance of academic excellence, community involvement, and institutional growth. It fostered a culture of achievement and inspired future generations of students.

Looking ahead, Kisii University aimed to:

- Expand research and innovation hubs.
- Strengthen industry partnerships.
- Promote entrepreneurship among graduates.
- Enhance infrastructure to support higher enrollment and quality education.

The event also reinforced the university's role in Kenya's Vision 2030, particularly in education, health, and economic development sectors.

Conclusion

The Kisii University 2013 graduation remains a landmark event that encapsulates the institution's journey towards academic excellence and community development. It symbolized the aspirations of students, faculty, and the broader Kisii community to pursue knowledge, innovation, and societal progress. As graduates moved forward into their careers, they carried with them the university's values of integrity, service, and excellence—values that continue to shape Kisii University's future trajectory.

Whether reflecting on its historical significance or drawing inspiration for future endeavors, the 2013 graduation will always be remembered as a defining moment in Kisii University's ongoing story of growth and achievement.

Question When did Kisii University hold its 2013 graduation ceremony? Kisii University held its 2013 graduation ceremony in December 2013. How many students graduated from Kisii University in 2013? Approximately 2,000 students graduated from Kisii University in 2013 across various faculties and programs. Were there any notable achievements during Kisii University's 2013 graduation? Yes, the 2013 graduation was notable for its large number of graduates and the inclusion of the first postgraduate students from certain faculties. Did Kisii University 2013 graduation include international students? Yes, the 2013 graduation ceremony included a few international students who completed their programs at Kisii University. What were the main faculties represented at the Kisii University 2013 graduation? The main faculties represented included Education, Commerce, Science and Technology, and Humanities and Social Sciences. Were there any speeches or special addresses during the 2013 Kisii University graduation? Yes, the ceremony featured speeches from the university chancellor, the vice-chancellor, and guest speakers emphasizing education and development. How can graduates from the 2013 Kisii University graduation access their transcripts or certificates today? Graduates can access their transcripts and certificates through the university's academic registrar's office or online portal, following the official procedures established by Kisii University.

Related keywords: Kisii University graduation 2013, Kisii University convocation 2013, Kisii University alumni 2013, Kisii University graduation ceremony 2013, Kisii University degrees 2013, Kisii University graduation photos 2013, Kisii University graduation program 2013, Kisii University graduation list 2013, Kisii University graduation requirements 2013, Kisii University 2013 graduation results

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