

KINEMATICS OF MACHINES

VELOCITY ANALYSIS

In a four link mechanism, the dimension of the links are as under, $AB = 50 \text{ mm}$, $BC = 58 \text{ mm}$, $CD = 55 \text{ mm}$ and $AD = 100 \text{ mm}$. At the instant when $\angle DAB = 60^\circ$ degree, the link AD has an angular velocity of 10.5 rad/sec in the counter clockwise direction. Determine

1. Velocity of Point C.
2. Velocity of Point E on the link BC, when $BE = 40 \text{ mm}$.
3. The angular velocities of the link BC and CD.
4. The velocity of an offset point "F" in link BC if $BF = 45 \text{ mm}$, $CF = 30 \text{ mm}$ and BCF is read clockwise.
5. The velocity of an offset point "G" on the link CD if $CG = 24 \text{ mm}$, $DG = 44 \text{ mm}$ and DCG is read clockwise.

Scale: $0.525 \text{ m/s} = 50 \text{ mm}$

mps to length: $1 \text{ m/s} = 85.24 \text{ mm}$

Length to mps: $1 \text{ mm} = 0.0105 \text{ m/s}$

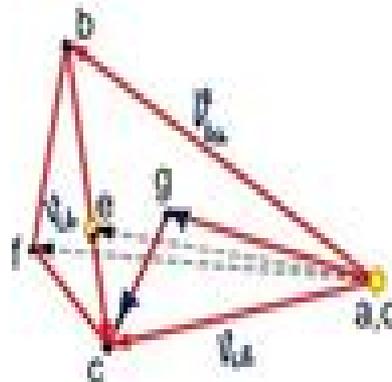
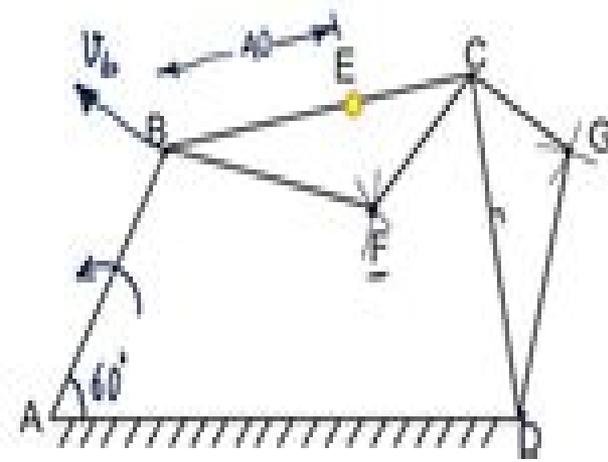
$$v = \omega r$$

$$\omega = \frac{v}{r}$$

$$\omega_{AD} = 10.5 \text{ rad/sec}, v_{Bd} = \omega_{AD} \cdot r_{AB}$$

$$= 10.5 \times 0.05$$

$$= 0.525 \text{ m/s}$$



1. Velocity of Point C $v_c = \omega \cdot r = 38 \text{ mm}$
 $= (38 \times 0.0105) \text{ m/s}$
 $= 0.4 \text{ m/s}$

2. Velocity of Point E on the link BC, when $BE = 40 \text{ mm}$

$$\frac{v_e}{v_c} = \frac{BE}{BC} \Rightarrow v_e = \frac{40}{58} \times 32 = 19.39 \text{ mm}$$

$$v_e = \omega \cdot r = 39 \text{ mm} = (39 \times 0.0105) \text{ m/s}$$

$$= 0.41 \text{ m/s}$$

3. The angular velocities of the link BC and CD

$$\omega_{BC} = \frac{v_{Bc}}{BC} = \frac{32 \times 0.0105}{0.066} = 5.09 \text{ rad/sec}$$

$$\omega_{CD} = \frac{v_{Cd}}{CD} = \frac{38 \times 0.0105}{0.056} = 7.125 \text{ rad/sec}$$

4. The velocity of an offset point "F"

$$v_f = f \cdot \omega = 48 \text{ mm} = 48 \times 0.0105 = 0.504 \text{ m/s}$$

5. The velocity of an offset point "G"

$$v_g = g \cdot \omega = 30 \text{ mm} = 30 \times 0.0105 = 0.315 \text{ m/s}$$

Kinematics Analysis Of Mechanisms Methods And

**Yan Chen,Lujiang Liu,Xinjun Liu,Haitao
Liu,Ming Li,Tao Sun**

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Machines and Mechanisms David H. Myszka,2005 Provides the techniques necessary to study the motion of machines and emphasizes the application of kinematic theories to real world machines consistent with the philosophy of engineering and technology programs This book intends to bridge the gap between a theoretical study of kinematics and the application to practical mechanism

Kinematic Analysis and Synthesis of Mechanisms Asok Kumar Mallik,Amitabha Ghosh,Gunter Dittrich,2021-09-30 This text reference represents the first balanced treatment of graphical and analytical methods for kinematic analysis and synthesis of linkages planar and spatial and higher pair mechanisms cams and gears in a single volume format A significant amount of excellent German literature in the field that previously was not available in English provides extra insight into the subject Plenty of solved problems and exercise problems are included to sharpen your skills and demonstrate how theory is put into practice

Kinematic Analysis and Synthesis of Mechanisms Asok Kumar Mallik,Amitabha Ghosh,Gunter Dittrich,1994-02-16 This text reference represents the first balanced treatment of graphical and analytical methods for kinematic analysis and synthesis of linkages planar and spatial and higher pair mechanisms cams and gears in a single volume format A significant amount of excellent German literature in the field that previously was not available in English provides extra insight into the subject Plenty of solved problems and exercise problems are included to sharpen your skills and demonstrate how theory is put into practice

THEORY OF MECHANISMS AND MACHINES C. S. SHARMA,KAMLESH PUROHIT,2006-01-01 Intended to cater to the needs of undergraduate students in mechanical production and industrial engineering disciplines this book provides a comprehensive coverage of the fundamentals of analysis and synthesis kinematic and dynamic of mechanisms and machines It clearly describes the techniques needed to test the suitability of a mechanical system for a given task and to develop a mechanism or machine according to the given specifications The text develops in addition a strong understanding of the kinematics of mechanisms and discusses various types of mechanisms such as cam and follower gears gear trains and gyroscope

Analytical Kinematics Roger F. Gans,1991-03-06 Using computational techniques and a complex variable formulation this book teaches the student of kinematics to handle increasingly difficult problems in both the analysis and design of mechanisms all based on the fundamental loop closure equation

Mechanism and Machine Theory J. S. Rao,Rao V. Dukkipati,2007 This Book Evolved Itself Out Of 25 Years Of Teaching Experience In The Subject Moulding Different Important Aspects Into A One Year Course Of Mechanism And Machine Theory Basic Principles Of Analysis And Synthesis Of Mechanisms With Lower And Higher Pairs Are Both Included Considering Both Kinematic And Kinetic Aspects A Chapter On Hydrodynamic Lubrication Is Included In The Book Balancing Machines Are Introduced In The Chapter On Balancing Of Rotating Parts Mechanisms Used In Control Namely Governors And Gyroscopes Are Discussed In A Separate Chapter The Book Also Contains A Chapter On Principles Of Theory Of Vibrations As Applied To Machines A Solution Manual To Problems Given At The End Of Each

Chapter is also available Principles of Balancing of Linkages is also included Thus the book takes into account all aspects of mechanism and machine theory to the reader studying a first course on this subject This book is intended for undergraduate students taking basic courses in mechanism and machine theory The practice of machines has been initially to use inventions and establishment of basic working models and then generalising the theory and hence the earlier books emphasises these principles with the advancement of theory particularly in the last two decades New books come up with a stress on specific topics The book retains all the aspects of mechanism and machine theory in a unified manner as far as possible for a two semester course at undergraduate level without recourse to following several text books and derive the benefits of basic principles recently advanced in mechanism and machine theory

Kinematics and Dynamics of Mechanical Systems Kevin Russell, 2016-04-05 Effectively apply the systems needed for kinematic static and dynamic analyses and design A survey of machine dynamics using MATLAB and SimMechanics Kinematics and Dynamics of Mechanical Systems Implementation in MATLAB and SimMechanics combines the fundamentals of mechanism kinematics synthesis statics and dynamics with real world application **Theory of Machines and Mechanisms** Joseph Edward Shigley, John Joseph Uicker, 1995 This book offers outstanding coverage of mechanisms and machines including important information on how to classify and analyze their motions how to synthesize or design them and how to determine their performance when operated as real machines To develop a broad comprehension all the methods of analysis and development common to the literature of the field are used *Advanced Theory of Mechanisms and Machines* M.Z. Kolovsky, A.N. Evgrafov, Yu.A. Semenov, A.V. Slousch, 2012-09-03 This book is based on a lecture course delivered by the authors over a period of many years to the students in mechanics at the St Petersburg State Technical University the former Leningrad Polytechnic Institute The material differs from numerous traditional text books on Theory of Machines and Mechanisms through a more profound elaboration of the methods of structural geometric kinematic and dynamic analysis of mechanisms and machines consisting in both the development of well known methods and the creation of new ones that take into account the needs of modern machine building and the potential of modern computers The structural analysis of mechanisms is based on a new definition of structural group which makes it possible to consider closed structures that cannot be reduced to linkages of Assur groups The methods of geometric analysis are adapted to the analysis of planar and spatial mechanisms with closed structure and several degrees of movability Considerable attention is devoted to the problems of configuration multiplicity of a mechanism with given input coordinates as well as to the problems of distinguishing and removing singular positions which is of great importance for the design of robot systems These problems are also reflected in the description of the methods of kinematic analysis employed for the investigation of both open tree type structures and closed mechanisms **Mechanisms** Jaime Gallardo-Alvarado, José Gallardo-Razo, 2022-06-18 Theory of mechanisms is an applied science of mechanics that studies the relationship between geometry mobility topology and relative

motion between rigid bodies connected by geometric forms Recently knowledge in kinematics and mechanisms has considerably increased causing a renovation in the methods of kinematic analysis With the progress of the algebras of kinematics and the mathematical methods used in the optimal solution of polynomial equations it has become possible to formulate and elegantly solve problems Mechanisms Kinematic Analysis and Applications in Robotics provides an updated approach to kinematic analysis methods and a review of the mobility criteria most used in planar and spatial mechanisms Applications in the kinematic analysis of robot manipulators complement the material presented in the book growing in importance when one recognizes that kinematics is a basic area in the control and modeling of robot manipulators Presents an organized review of general mathematical methods and classical concepts of the theory of mechanisms Introduces methods approaching time derivatives of arbitrary vectors employing general approaches based on the vector angular velocity concept introduced by Kane and Levinson Proposes a strategic approach not only in acceleration analysis but also to jerk analysis in an easy to understand and systematic way Explains kinematic analysis of serial and parallel manipulators by means of the theory of screws

Advances in Mechanism and Machine Science and Engineering in China

Yan Chen,Lujiang Liu,Xinjun Liu,Haitao Liu,Ming Li,Tao Sun,2025-05-13 This book collects selected papers of the 24th IFToMM China International Conference on Mechanism and Machine Science and Engineering CCMMS 2024 CCMMS was initiated in 1982 and it is the most important forum held in China for exchange of research ideas presentation of technical and scientific achievements and discussion of future directions in the field of mechanism and machine science The topics include theoretical and computational kinematics dynamics and control engines and transmission systems parallel hybrid mechanisms and industrial robotics compliant mechanisms origami mechanisms and soft robotics metamorphic mechanisms and robotics deployable structures and mechanisms aerospace mechanisms and environmental effects micro nano mechanisms and robotics biologically inspired mechanisms and robotics medical and rehabilitation robotics mobile robotics and heavy non road mobile machines history of mechanisms machines and robotics and engineering education on mechanisms This book provides a state of the art overview of current advances in mechanism and machine science in China The inspiring ideas presented in the papers will enlighten the trend in academic research and industrial application The potential readers include academic researchers and industrial professionals in the field of mechanism and machine science

Classical and Modern Approaches in the Theory of Mechanisms Nicolae Pandrea,Dinel Popa,Nicolae-Doru

Stanescu,2017-04-24 Classical and Modern Approaches in the Theory of Mechanisms is a study of mechanisms in the broadest sense covering the theoretical background of mechanisms their structures and components the planar and spatial analysis of mechanisms motion transmission and technical approaches to kinematics mechanical systems and machine dynamics In addition to classical approaches the book presents two new methods the analytic assisted method using Turbo Pascal calculation programs and the graphic assisted method outlining the steps required for the development of graphic

constructions using AutoCAD the applications of these methods are illustrated with examples Aimed at students of mechanical engineering and engineers designing and developing mechanisms in their own fields this book provides a useful overview of classical theories and modern approaches to the practical and creative application of mechanisms in seeking solutions to increasingly complex problems

A Generalized Method for the Dynamic-kinematic Analysis of Arbitrary Spatial Mechanisms Using the Digital Computer Brij Mohan Khandelwal,1974

Kinematic and Kinetic Analyses of Spatial Mechanisms and Vibration Analysis of Elastic Linkages Youngil Youm,1976

Distinguished Figures in Mechanism and Machine Science Marco Ceccarelli,Alessandro Gasparetto,2022-12-02 This book discusses the technological developments achieved by distinguished figures in the history of mechanism and machine science MMS This is the fifth volume of a series of books which gathered contributions on the leading scientists in the field This book focuses specifically on the IFToMM community and its activities over the last 50 years showcases who is who in MMS and emphasizes together with the previous books of the series the significance of MMS through time Each chapter recognizes persons whose scientific work resulted in relevant technical developments in the historical evolution of MMS within IFToMM Biographical notes describing the efforts and achievements of these persons are included as well but a technical survey is the core of each chapter offering a modern interpretation of their legacy

Lectures to Science Teachers. The Kinematics of Machinery ... Alexander Blackie William Kennedy,1876

Intelligent Robotics and Applications Ming Xie,Youlun Xiong,Caihua Xiong,Zhencheng Hu,2009-12-14 The market demands for skills knowledge and personalities have positioned robotics as an important field in both engineering and science To meet these challenging demands robotics has already seen its success in automating many industrial tasks in factories And a new era will come for us to see a greater success of robotics in n industrial environments In anticipating a wider deployment of intelligent and auto mous robots for tasks such as manufacturing eldercare homecare edutainment search and rescue de mining surveillance exploration and security missions it is necessary for us to push the frontier of robotics into a new dimension in which motion and intelligence play equally important roles After the success of the inaugural conference the purpose of the Second International Conference on Intelligent Robotics and Applications was to provide a venue where researchers scientists engineers and practitioners throughout the world could come together to present and discuss the latest achievement future challenges and exciting applications of intelligent and autonomous robots In particular the emphasis of this year s conference was on robot intelligence for achieving digital manufacturing and intelligent automations This volume of Springer s Lecture Notes in Artificial Intelligence and Lecture Notes in Computer Science contains accepted papers presented at ICIRA 2009 held in Singapore December 16 18 2009 On the basis of the reviews and recommendations by the international Program Committee members we decided to accept 128 papers having technical novelty out of 173 submissions received from different parts of the world

Mechanism Analysis Lyndon O. Barton,1993-01-19 This updated and enlarged Second Edition provides in depth progressive studies of kinematic mechanisms

and offers novel simplified methods of solving typical problems that arise in mechanisms synthesis and analysis concentrating on the use of algebra and trigonometry and minimizing the need for calculus It continues to furnish complete coverage of key concepts including kinematic terminology uniformly accelerated motion and the properties of vectors graphical techniques for both velocity and acceleration analysis analytical techniques and ready to use computer and calculator programmes for analyzing basic classes of mechanisms This edition supplies detailed explications of such new topics as gears gear trains and cams velocity and acceleration analyses of rolling elements acceleration analysis of sliding contact mechanisms by the effective component method four bar analysis by the parallelogram method and centre of curvature determination methods *Kinematics and Design of Mechanisms* Alexander Cowie,1961 *Advanced Manufacturing and Information Engineering, Intelligent Instrumentation and Industry Development* J.Z. Ma,Fang Shao,L.P. Hu,J. Liu,D.M. Chen,2014-08-11 Selected peer reviewed papers from the 2014 2nd International Conference on Precision Mechanical Instruments and Measurement Technology ICPMIMT 2014 May 30 31 2014 Chongqing China

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