# MONOGRAPHS

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## Mathematical Methods of Mechanics

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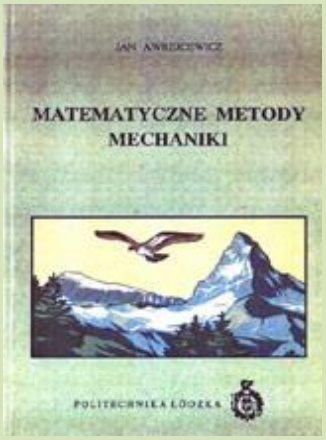
**SUMMARY**




Preface & Contents

**Book Review**

This work can be treated as the text book and is meant for students of Mechanical Engineering in the disciplines like "Robotics", "Applied Mechanics", "Biomechanics" and also for the Ph.D. students of "Mechanics" and "Machine Design and Exploitation". In addition, it can be useful for the students of Applied Mathematics and Technical Physics. This book can be treated as a "bridge" between the theoretical approaches in the theory of differential equations and applications in mechanics. A general introduction is presented in Chapter 1.

Chapter 2 includes explicit and implicit, homogeneous and non-homogeneous first order differential equations. A special attention is paid to derivation of the differential equations and to physical examples. The higher order differential equations with the examples are also described in Chapter 3. The Peano and Cauchy-Picard theorems are given and some examples of differential equations with periodic coefficients are illustrated.

Chapter 4 includes introduction and classification of dynamical systems. First of all, a general background of dynamical systems is given. Then their classification is outlined and a derivation of equations of motion is described. Oscillations of one- and two-degrees-of freedom are discussed in Chapter 5. In the beginning one degree-of-freedom systems are analysed. A special attention is paid to parametric vibrations. The Hill, Meissner and Mathieu equations are deeply analysed and mechanical examples are considered. An introduction to the general theory of oscillations and the systems of linear differential equations with constant and periodically variable coefficients are described in Chapter 6.

Chapter 7 is devoted to analysis of chaotic oscillations and the routes leading to chaos. The introduction to catastrophe theory is outlined in Chapter 8. Finally, the numerical methods for a global oscillations analysis are given in Chapter 9. The Runge-Kutta and Bulirsch-Stoer methods, integrations of conservative systems, stilt differential equations, the Rosenbrock and prediction-correction methods are considered, among others.