Dynamics for engineers by Bichara B. Muvdi, Amir W. Al-Khafaji and John W. McNabb (Springer, 1997).

This is a very comprehensive book for engineering students, both as accompanying literature for university courses and for private studies. The overall concept follows classical rules. The book considers kinematics as a basis of motion geometry and proceeds then to kinetics as cause and effect of motion by forces. These two dependent and closely connected areas are applied to particles and rigid bodies, where in the last case two- and three-dimensional kinematics and kinetics are treated in an order of increasing complexity.

According to this concept the book starts with particle kinematics, defines velocity and acceleration and considers rectilinear, curvilinear and relative motion. Moving to particle kinetics the concepts of the forces, energy and momentum are introduced. Newton’s laws of motion are discussed, and especially Newton’s second law is presented in various coordinate frames. The class of central forces in combination with celestial and space mechanics lead to Kepler’s laws, and as an application to space technology to the well-known elliptic, parabolic and hyperbolic trajectories for spacecrafts are evaluated.

From this the authors proceed to particle energy by introducing the kinetic energy and establishing the work-energy principle for particles and systems of particles. With a definition of conservative forces and of the gravitational and elastic potential energies the principle of conservation of mechanical energy is finally established. Particle dynamics closes with a presentation of linear and angular momenta, the corresponding conservation laws, and of a basic discussion of impact and impulses. These fundamentals are applied to some basic problems of steady fluid flow, of systems with variable mass like rockets and of space dynamics.

Rigid body dynamics commences with two-dimensional kinematics and kinetics, which certainly makes sense from the pedagogical standpoint of view. The sequence of fundamentals like kinematics with translations and rotations, Newton-Euler-kinetics with the concept of forces (torques) and accelerations, the energy and momentum principles are repeated in a similar form for three-dimensional rigid body-dynamics and might thus help the students to understand the main issues of dynamics with more ease. As before all these chapters are written very thoroughly and with regard to an undergraduate course very comprehensively. Two- and three-dimensional kinematics includes rectilinear and curvilinear translation, motion around a fixed point, relative kinematics and the general concept of three-dimensional motion with translation and rotation. The energy and momentum principles are discussed more extensively in the two- than in the three-dimensional case. Nevertheless the course offers the student the knowledge how to establish equations of motion and how to solve them.

As a last chapter authors present an introduction into simple modeling of free and forced vibration and a short overview of Lagrange’s method in connection with multi-degree-of-freedom-systems. Some useful appendices complete the book.

This second volume of an undergraduate textbook on mechanics is structured in a convincing way and written in a very precise and clear form. The reviewer knows
from own undergraduate courses with thousands of students that precision, clearness and comprehensibility are indispensable features of such courses. The book meets excellently these requirements confirming its high standing. All chapters are accompanied by many well selected examples covering mechanical engineering and aerospace fields. They might fill half of the volume, and are indeed very valuable for understanding the general fundamentals. One can congratulate the authors to this selection.

The reviewer has detected only two points where gentle critics might be allowed. Firstly d'Alembert's principle is mentioned only shortly and not used in the text-book. Nevertheless it seems to me that it should not be interpreted as some principle of dynamic equilibrium. The fundamental feature of d'Alembert's principle consists in a statement about passive forces which cannot be shifted thus producing no work. Though this statement was reworked much more clearly by Lagrange (1788) it was already a basic idea in d'Alembert's book (1758).

Secondly, particle kinematics and kinetics fill nearly half the volume. Although this helps to understand basic dynamics more easily it should be remembered that in mechanical engineering particle dynamics is of very small importance.

Dynamic for Engineers is written for engineering students, for whom it can be recommended without any restrictions. The reviewer feels that it might as well be very useful for practitioners in industry, who very often have to judge mechanical problems without being able to step very deeply into the matter. The book might give them useful support. I wish much success to it.

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