Preface

The Antikythera astronomical calculating device invented in the ancient Greece between 150–100 BC was discovered from the Antikythera shipwreck of the Mediterranean in 1900–1901. The device was the oldest astronomical calculator for the function of indicating the date of Egyptian calendar, displaying the motions of the Sun, the Moon, and the five planets, showing moon phases, calculating the calendars, and predicting eclipses. The interior structure of mechanism is composed of gear trains with six subsystems corresponding to its functions. Nevertheless, the device was absolutely strange to everyone in the era of the discovery. None of known ancient artifacts bears any resemblance to this excavated mechanical device, and the historical records or literatures about such a geared device were not available. Owing to the damages caused by excavation in some fragments, subsystems are incomplete, unclear, and even lost. Decoding the mechanisms and reconstructing the device are much more difficult, even with advanced modern image technology.

This book presents a unique systematic design methodology to decode the interior mechanisms of the Antikythera device. The historical background, the surviving evidence, and the existing reconstruction works of the device are introduced, and the historical development of astronomical achievements and various astronomical instruments is investigated. By utilizing the methodology based on the conceptual design of modern mechanisms, all feasible designs of the six lost/incomplete/unclear subsystems subject to the standards of science and technology in the time period are synthesized as illustrated examples, and 48 feasible designs of the complete interior mechanisms are presented. Such a design methodology provides not only a logical tool applying the knowledge of mechanical engineering for the reconstruction designs of the Antikythera device, but also an innovative research approach for identifying the original structure of mechanisms in the future.

The book is organized in such a way that it can be used for research, science education, and self-study. It can be used as a supplementary note for readers who are interested in the Antikythera device. Chapter 1 outlines the historical development of Western astronomy, including cosmology, calendars, astronomical events, and

astronomical theory. Chapter 2 introduces the ancient astronomical instruments and analyzes the designs corresponding to some special functions. Chapter 3 introduces the historical background, known functions, and structure analysis of the Antikythera mechanism. Chapter 4 describes the existing reconstruction works. Chapter 5 presents the design methodology and compares the authors' reconstruction designs with other available ones. Chapters 6–10 are the reconstruction designs of the calendrical subsystem, the lunar subsystem, the solar subsystem, the planetary subsystem, and the moon phase display device, respectively. Chapter 11 explains the geometric constraints and detailed designs of assembly work and presents all feasible designs of complete interior structure along with a 3D model.

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The authors believe that this book will meet the needs of academic research, archaeological research, and teaching in the reconstruction designs of ancient machinery and creative designs of modern mechanisms. Comments and suggestions for the improvement and revision of the book will be highly appreciated.

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