Hydromechatronics in the New Industrial Revolution
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With continuous innovations in information technology and rapid developments in the manufacturing industry, new theories and ideas are constantly emerging, and the world is now witnessing a new industrial revolution with information technology and intelligent manufacturing as its core areas. Hydromechatronics technology is one of the indispensable key technologies in this new industrial revolution (often known as Industry 4.0).

As a fusion of mechanical, electrical and hydraulic technologies, hydromechatronics – especially hydraulic transmission and control – has become a fundamental technology in modern mechanical engineering by possessing the characteristics of high-energy transmission density and high response speed, and the capability of multi-objective drive control. It has created a multi-disciplinary research field, involving mechanical engineering, electric engineering, optics, control, computer science, information technology, etc., which has broad applications in aerospace, rail transportation, ships, high-end CNC machine tools, robotics, petrochemical, metallurgy, mining, marine and other related fields.

The biggest advantage of hydromechatronics is its capability of information processing. The trend for its development lies in intelligence, environmental friendliness and miniaturisation. Intelligence refers to machines becoming highly informationised, so that they can automatically manage all kinds of problems encountered during operation through, for example, automatic condition monitoring, diagnosis and maintenance. This can not only improve production efficiency, but also reduces the waste of resources. Environmental protection is a hot topic for human society at present. In the production process, it is necessary to minimise energy consumption and pollutant emissions while ensuring efficiency. The most representative applications in this area include the installation of electronic monitors and deep well detectors in modern mechanical equipment. The requirement of compactness, light weight, low power consumption and high reliability for hydromechatronic systems has led in recent years to the rapid development of miniaturisation technology in recent years. By integrating with microelectromechanical systems (MEMS) and advanced electronics, traditional hydraulic system are constantly improved and gradually transformed.

To give an example of how advances in hydromechatronic technologies affect industrial development, we will briefly review new trends in hydromechatronic servo systems. The advancements of hydromechatronic servo systems aim to improve energy efficiency, reliability and response speed while reducing cost. Numerous efforts are being made to develop new drive modes and new materials for the servo valve, to explore new principles or design new structures, and to apply digital control technology, etc. By using a linear motor or servo motor to directly drive the valve core, the usage of easily contaminated components can be greatly decreased. Meanwhile, the fast frequency response of the motor is beneficial for achieving rapid switching of the working port and rapid adjustment of the throttle. Furthermore, novel functional materials such as piezoelectric materials, magnetostrictive
materials and shape memory alloys have shown good motion characteristics. They have great potential for replacing the traditional torque motors in the pilot-level drive of electrohydraulic servo valves.

In the machinery equipment industry, the integration of digital communications with manufacturing and testing technologies is a new trend. Based on digital communication techniques, a host computer can send instructions to electrohydraulic servo systems through CAN bus or Ethernet, achieving real-time parameters transmission and online monitoring of operation conditions. Another hot topic in this field is the development of high-frequency electrohydraulic servo systems. Current electrohydraulic servo systems usually operate at about 100 Hz, which greatly limits their application fields. If the operating frequency can be broadened to 1000 Hz through the development of voice coil servo valves or piezoelectric servo value, the dominance of the electric shaker in the high-frequency shaking table field can be overturned. Finally, highly integrated electrohydraulic servo systems are becoming more favourable due to ease of operation, installation and maintenance. By integrating the fuel tank, motor, pump, servo valve, actuators and sensors during the design stage, more flexible, intelligent and reliable electrohydraulic servo systems can be produced.

Based on the recognition and a deep appreciation of the importance of hydromechatronics in the new industrial revolution, the Fluid Control Engineering Committee of the Chinese Society of Theoretical and Applied Mechanics decided to found a journal in this field: the *International Journal of Hydromechatronics (IJHM)*. This journal is organised by the Chongqing Real Estate College and the Chongqing University of Technology, and is strongly supported by both the State Key Laboratory of Fluid Power and Electrical Control of Zhejiang University (SKLoFP) and the State Key Laboratory of Mechanical Transmission of Chongqing University (SKLMT). *IJHM* will present up-to-date reports on significant new findings in basic theory and innovative applications in hydromechatronics and its interdisciplines, and aims to become an effective research exchange platform with global scope.