New Product

Digital Color Ultrasound Diagnostic System

Explores the Interior of the Human Body with "Sound"

Finer ultrasound beam and sophisticated signal processing create high-definition, real-time displays of blood flows and heart movements.

SDU-2200

Utilizes Reflection of Harmless Ultrasound

Music, dogs barking, telephones ringing - we are enveloped by sound. Not only is sound harmless to us, but life without it would be very difficult. Using sound to investigate the human body as an aid to medical treatment is the role of the ultrasound diagnostic system. However, the sound exploited by these systems is ultrasound with a frequency of 1 to 10 megahertz (1 to 10 million hertz), far above the human audible range of 30 Hz to 20,000 Hz. Despite the high frequency, the properties of ultrasound are fundamentally identical to audible sound it is harmless to humans, it requires some medium for transmission, and its speed depends on the transmission medium. Ultrasound reflects from objects as sound echoes from mountains. An ultrasound diagnostic system is based on ultrasound reflecting off of objects.

However, although ultrasound reflects off of objects, it does not reflect randomly. Each substance has an intrinsic property called acoustic impedance, which is the density of the substance multiplied by the speed of sound in that substance. Sound is reflected from the boundary between materials of different intrinsic acoustic impedance. The degree of acoustic reflection depends on the difference in intrinsic acoustic impedance: an extremely large difference in acoustic impedance results in almost all sound being reflected, while a very small difference causes virtually no reflection.

Position Detected from Time Differences in Reflected Ultrasound Waves

Why is this difference so useful in imaging a fetus floating in the amniotic fluid of the womb or for the internal organs of the body? A ratio of ultrasound waves transmitted through the amniotic fluid are reflected from the border between amniotic fluid and fetus namely from the body surface of the fetus while the remainder of the ultrasound is transmitted through the fetal organs. Some of the ultrasound transmitted through the fetus is reflected from the next boundary, the other side of the body of the fetus, and the remainder is transmitted into the amniotic fluid. By detecting these two ultrasound reflections, the thickness of the fetus' body at the position of ultrasound incidence can be calculated from the time difference. A cross-section image of the fetus' body can then be created by arranging the thickness at each organ and tissue on the mother body, obtained from a detailed ultrasound scan. This is the principle behind ultrasound diagnostic systems, which generate a fine ultrasound beam to reveal fine details about the body of the fetus.

Recently, systems using ultrasound reflection have also been used in automobiles to detect obstacles. Almost all ultrasound is reflected from an obstacle due to the extremely large difference in intrinsic acoustic impedance between it and the air. Although obstacles can be detected only at certain distances, the systems is satisfactory for an automobile obstacle detector.

Blood Flow Movements Detected by Applying the Doppler Effect

The Doppler effect with sound is well known. It is the phenomenon that makes the siren of an approaching ambulance or the roar of an approaching car sound high, while the same sounds produced by a retreating ambulance or car sounds lower. The movement of the sound source results in a higher or lower frequency where the sound is heard, and the higher the speed of the sound source, the greater the difference in sound pitch. The Doppler effect occurs also when sound is reflected a fact exploited by the blood flow display functions of ultrasound diagnostic systems. When blood flows away from the ultrasound receiver/generator, the frequency

of the reflected ultrasound is lower than the frequency of the generated ultrasound. A greater frequency difference indicates a higher blood velocity, and the color ultrasound diagnostic system can color-code the display to indicate the current blood flow status. A region of poor blood flow due to thrombosis or some other problem is displayed in a different color to other regions.

Femoral artery and vein

Fetus

Technology Supports High Diagnostic Capacity

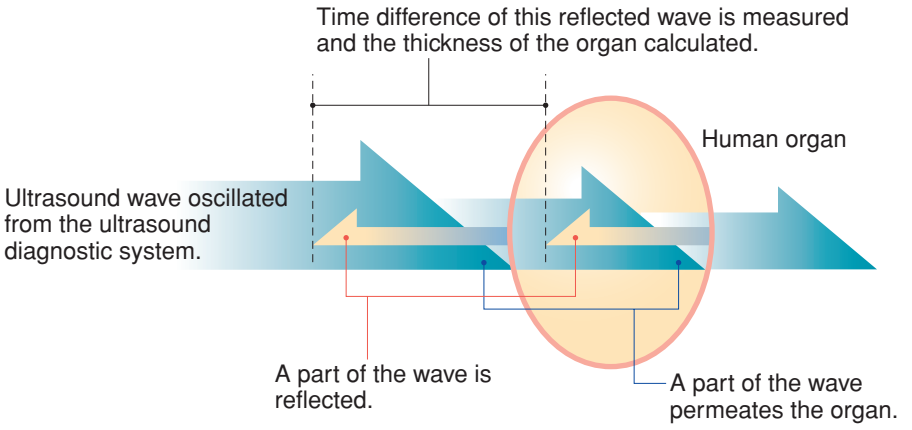
The Color Ultrasound Diagnostic System displays a cross-sectional image of living tissue, based on the concepts above, and superimposes the blood flow movements onto this cross-sectional image.

Good diagnostic performance requires that an ultrasound diagnostic system have a resolution high enough to view even the smallest lesion, and a frame rate high enough to capture instantaneous blood flow abnormalities and kinetic abnormalities of the heart. The latest ultrasound diagnostic systems incorporate a digital beam former that focuses down to the size of the constituent pixels of the image to create high-resolution cross-section images. The diagnostic efficiency is enhanced by both the real-time imaging achieved with dedicated LSIs developed specifically for the system, which use simultaneous reception of reflected ultrasound signals from four directions and other techniques to improve signal processing speed, as well as by a frame rate high enough to capture instantaneous abnormalities in blood flow.

Medical diagnostic systems demand not only these basic technologies, but must also deliver a high diagnostic capacity in all situations. Many image parameters are used by ultrasound diagnostic systems to permit application across a range of diagnostic areas, including the heart, embryos, and the abdominal organs. This function uses sophisticated collaboration between hardware and software to instantaneously set the huge number of parameters appropriate to each diagnostic area.

The high diagnostic capacity achieved by various supporting functions and technologies will likely make the Color Ultrasound Diagnostic System a widely used diagnostic system in the medical field.

Fig. 1 Principle of capturing shapes such as human organs using ultrasound reflection (schema)



Award

Shimadzu Honored For Environmental Protection Activities

Delighted CEOS including Shimadzu (second from the right in front row), Sony and others.

The ceremony in the presence of the Prince and Princess Akishinomiya of Japan.

Shimadzu Receives Minister of Education and Science Award in the World Environment Awards sponsored by the Japan Industrial Journal

Shimadzu has been selected to receive the Minister of Education and Science Award in the 10th Annual World Environment Awards sponsored by the Japan Industrial Journal, one of Japan's leading specialist industrial newspapers. The award ceremony was held on April 18.

The World Environment Awards honor enterprises and local authorities that actively pursue environmental protection activities. Of 108 applicants, 10 corporations, including Sony that received the largest prize, and two local government authorities were recognized.

This is the second time Shimadzu has been recognized with a World Environment Award, having received the 5th Science and Technology Agency Director General's Prize.

Shimadzu was awarded for contributions to environmental protection on a global scale, including environmental protection with analytical and measuring instruments, the active pursuit of environmental management activities both inside and outside the company, strong support for UN University environmental monitoring and analysis projects in the East Asian region, and the reduction of CO_2 greenhouse gases by developing CO_2 fixing technology.

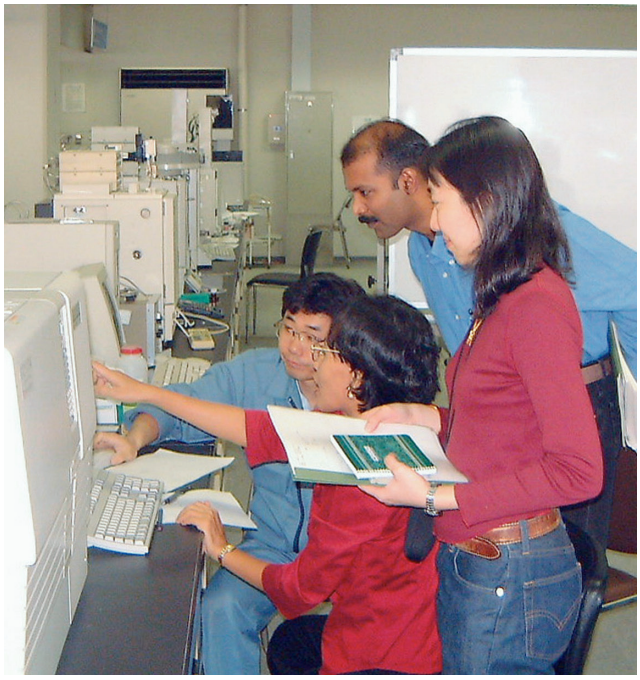
Free Courses on Obtaining ISO 14001 Certification

Tackling Environmental Management

Shimadzu acquired ISO 14001 certification in 1997. The company actively strives to cut factory noise, lower volumes of discarded paper, reduce power consumption, conduct product recycling design, and promote green procurement.

Shimadzu also offers free courses on obtaining ISO 14001 certification for customers and industries, and undertakes environmental protection activities inside and outside the company.

Since 1998, Shimadzu has run a total of 58 courses, attended by over 2,500 people.



Training workshop for UN University Project

Environmental Monitoring in ASIA

Cooperation with UN University Project

Shimadzu has supported the "Environmental Monitoring and Analysis in the East Asian Region" project since 1996 by financially supporting operating costs, providing analytical instruments, and offering technical training.

Shimadzu supports this project under its operational principle of Realizing Our Wishes for the "Well-being of Mankind and the Earth." Nine countries participate in the project: Japan, China, Singapore, Korea, Thailand, Indonesia, Malaysia, Vietnam, and the Philippines. Shimadzu has donated Gas Chromatograph-Mass Spectrometers (GCMS) to each participating country, and also runs a training workshop each year for researchers at the organizations participating in the international symposium.

These workshops train the technical staff from each country to continuously acquire reliable environmental data and also promote environmental database creation and personal networking.

The initial stage of the project from 1996 to 1999 involved the standardization of analytical techniques for monitoring the concentrations of chemical pollutants in drinking water, soil, food, and air in East Asia.

The second stage from 1999 to 2002 monitors and analyses endocrine disrupter compounds (EDCs) in the waterways and coastal areas of East Asia.

Shimadzu is continuing to provide the same level of support for the second stage as it did for the first, and in addition has established joint laboratories at universities in Vietnam and Malaysia, both countries participating in the project.

CO_2 Fixing Technology

to Help Prevent Global Warming

CO_2 is thought to be the major culprit behind global warming. The world generates six billion tonnes of carbon dioxide gas each year, of which Japan produces 320 million tonnes. CO_2 fixing is a means of converting this troublesome gas into something useful, instead of simply discharging it into the atmosphere.

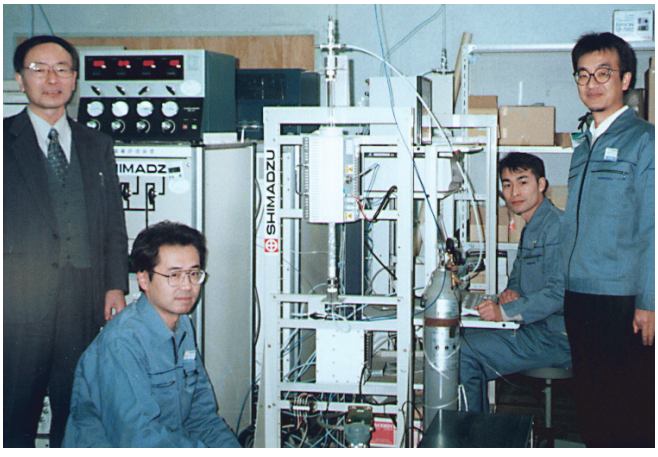
The development of this technology started with research into maintaining oxygen and water in space. This unique, previously unknown CO_2 fixing method uses revolutionay technology to convert the CO_2 humans exhale in a sealed space into oxygen and water.

The technology was jointly developed with the Research Institute of Innovative Technology for the Earth (RITE), and verification testing of the technology began last July at the Shizuoka Plant of one of Japan's major breweries, Sapporo Breweries Ltd.

The CO_2 fixing system developed by Shimadzu uses methane generated by the action of micro-organisms on organic waste products as the source of the hydrogen for CO_2 fixing, and thus requires only about 1/10 the energy costs of previously proposed CO_2 fixing methods.

The verification testing used biogas generated in the brewery. The carbon produced by the fixing process has a different crystalline structure and properties from carbon produced by conventional means, and it may well find application as a new industrial material.

Calculations show that applying this system to food processing plants and paper and pulp plants, which generate organic waste similar to a brewery, could fix some three million tonnes of carbon from the approximately seven million tonnes of organic waste produced each year. Such a reduction would be a dramatic step towards solving the greenhouse gas problem.



At a lab in Sanjo Works.