FOR IMMEDIATE RELEASE

Technology significantly reducing reverberation for high quality TV conferencing systems

- Reverberation reduced to $^{1}/_{9}$ in a meeting room with a microphone array -

Tokyo, Japan, March 13, 2012 – Hitachi, Ltd. (NYSE: HIT/TSE: 6501, hereafter, Hitachi) today announced the development of a speech-processing technique for high quality TV conferencing systems which dramatically reduces reverberation caused by sound reflected off various surfaces in a room, such as the ceiling, walls, equipment, etc. This "de-reverberation" technique allows voice clarity in communication over TV conferencing systems to be achieved by simply setting up a microphone array* and a personal computer in the meeting room enabling reverberation to be reduced regardless changes in the speaker position or direction faced. In verification tests using a $50m^2$ meeting room with a capacity of 20 people, unadjusted reverberation was confirmed to have been reduced to one-ninth.

In recent years, as the corporate globalization continues, TV-conferencing systems as a communication tool between distant offices are being increasingly employed as a means to reduce travel costs and increase work efficiency. In order to achieve even smoother TV-conferencing, research is being conducted to reduce reverberation resulting from time lags occurring as a result of a speaker's voice being reflected off surfaces in the meeting room before reaching the microphone. Conventional techniques reduce reverberation by removing estimated reverberation based on the assumption that the arrival time of reverberation to the microphone and the volume (reverberation pattern) is constant. In reality, when a speaker faces a different direction or changes position, the reverberation pattern changes, and therefore high precision removal of reverberation was an issue.

To address this issue, Hitachi has developed a de-reverberation technique which reduces reverberation in real-time with high precision regardless of changes in speaker position or facing-direction, and which does not require data such as room size or layout in advance. Features of the technology developed are as described below.

(1) Estimation reverberation patterns including fluctuations

Using a microphone array, which can determine the direction from which voice has arrived, voice directly picked-up and reverberation arriving delayed from various

directions over the past 5 seconds, undergo separation processing. Further, from the separated reverberation component, the amount of fluctuations in arrival time and reverberation patterns are used to estimate reverberation patterns accounting for fluctuations.

(2) Highly precise de-reverberation based on real-time estimation of reverberation volume

Based on the estimated reverberation pattern in (1), the reverberation component of the voice being input is estimated, and highly precise de-reverberation is conducted in real-time taking into consideration balance with the volume of the voice which needs to be heard.

Expectation-maximization algorithm (a probabilistic optimization method) was applied in the above processing.

In verification tests using the de-reverberation technique developed, it was confirmed that reverberation was reduced to one-ninth in a 50m^2 meeting room with a capacity of 20 people where the speaker was located approximately 4m from the microphone array.

This technique will not only improve communication quality in conference room TV conferencing systems but also contribute to improving the precision of speech-recognition in interactive robots operating indoors.

These results will be presented at the 2012 Spring Meeting of the Acoustical Society of Japan, which being held from 13th to 15th March 2012 at Kanagawa University, Yokohama, Japan, and at the 37th IEEE International Conference on Acoustics, Speech, and Signal Processing, which will be held from 25th to 30th March 2012 in Kyoto, Japan.

* Microphone array: a microphone in which several microphones devices are laid out in an array. From the differences in voice arrival time at each device, the position of the sound source can be identified.

About Hitachi, Ltd.

Hitachi, Ltd., (NYSE: HIT / TSE: 6501), headquartered in Tokyo, Japan, is a leading global electronics company with approximately 360,000 employees worldwide. Fiscal 2010 (ended March 31, 2011) consolidated revenues totaled 9,315 billion yen ($112.2 billion). Hitachi will focus more than ever on the Social Innovation Business, which includes information and telecommunication systems, power systems, environmental, industrial and transportation systems, and social and urban systems, as well as the sophisticated

materials and key devices that support them. For more information on Hitachi, please visit the company's website at http://www.hitachi.com.

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