

# **Something that we can hardly find in nature: wireless power transmission based on optoelectronics**

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## **Abstract**

The holy grail of smart technology might be to mimic biological systems by sensing surrounding environments, processing information and respond to them in real time. Within our society, there are increasing demands to adopt smart materials, sensing and structure technologies for civil infrastructure monitoring and maintenance. A wide range of research is ongoing in the areas of sensing, sensor networking, signal processing, power harvesting, and hardware/middleware/software development in order to improve the structural performance, safety and maintenance. In recent years, nondestructive testing (NDT) has gained popularity for structural health monitoring and damage detection applications. Among the NDT methods, guided waves based NDT techniques have attracted many researchers' attentions due to their relative long sensing range. These guided waves in a structure can be generated and sensed by a variety of techniques. Our study proposes a new scheme for PZT excitation and sensing based on laser and optoelectronic technologies where power as well as data can be transmitted via laser. This paper mainly focuses on the excitation aspect of the ultimate goal. An arbitrary waveform is generated using a light source and transmitted to the PZT. Then, the photodiode connected to the PZT converts the light into an electrical signal and excite the PZT. The technique can be configured either for wired or wireless PZT excitations. Finally, the feasibility of the proposed power transmission scheme has been experimentally demonstrated in a laboratory setup.

## **Bibliography**

Hoon Sohn received his B.S. (1992) and M.S. (1994) degrees from Seoul National University, Seoul Korea and Ph.D. (1999) from Stanford University, California, USA, all in Civil Engineering. He worked at Los Alamos National Laboratory (LANL) from

1999 to 2004 as a Technical Staff Member and in the Civil and Environmental Engineering Department at Carnegie Mellon University for 2004-2007 as an Assistant Professor. He is now an Associate Professor at KAIST (Korea Advanced Institute of Science and Technology) in Korea. Over last fifteen years, his research interest has been in the area of structural health monitoring and sensing technologies. He has been working on the structural health monitoring research to develop various data interrogation and damage detection techniques based on a unique statistical pattern recognition approach. Other research interests include active sensing, structural dynamics, system identification, smart materials & structures, modal analysis & vibration testing, signal processing, data interrogation, probabilistic & statistical analysis, and statistical pattern recognition. He has published more than 55 refereed journal articles, over 165 conference proceedings, and 4 book chapters. He is the recipient of the 2007 Young Scientists Award from Korean Academy of Science and Technology, which is similar to the Presidential Early Career Award from US National Science Foundation, and also won several Best Paper Awards from prestigious International Conferences including SPIE. He serves as an associate editor for the International Journal of Structural Health Monitoring and ASCE, Journal of Computing in Civil Engineering, and as an editorial board member for the International Journal of Smart Structures and Systems. He is a member of the American Society of Civil Engineers (ASCE) and the American Society of Mechanical Engineers (ASME), Society of Experimental Mechanics (SEM), and International Society of Optical Engineering (SPIE). His research work has been sponsored by US National Science Foundation, US Air Force, US Air Force Research Laboratory, the Boeing Company, US Transportation Research Board, Pennsylvania Infrastructure Technology Alliance, Pennsylvania Department of Transportation, Korea Research Foundation, Korea Science and Engineering Foundation, Korea Ministry of Construction and Transportation, Korea Agency for Defense Development, Smart Infra-Structure Technology Center, Bombardier Corporation, Miltec Corporation, United Technology Research Center, POSCO and other industries.