

SPRING 2007 SEMINAR SERIES

Date: Tuesday, May 15, 2007

Time: 11:00 am – 12:00 pm

Room: SL 165

Everyone is invited

**STRESSES IN OPTICAL WAVEGUIDES AND THEIR EFFECTS ON
OPTICAL PERFORMANCE**

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Abstract. Optical waveguides are basic components in photonic systems. Inhomogeneous and anisotropic stresses are induced in the optical waveguides during the processing, package and usage. Due to the elasto-optic effect, the stresses can distort the distribution of refractive index, thus influencing the performance of optical waveguides. The talk will summarize my recent works on this topic. To gain an insight into the stress effects on the optical performance, I will first discuss an idealized slab optical waveguide under different stress states. It is found that different stress states play different roles in affecting the optical performance: high stress magnitude causes multimode; anisotropic stress causes birefringence; and stress concentration causes transition loss. I will then talk about the stress effects on the channel waveguides, which are commonly used in photonic devices. Closed-form solutions are developed to estimate the thermal stresses and their effects on optical performance of a buried rectangular channel waveguide. These analytical solutions are consistent with finite element simulations and experimental measurements, and convenient to be used in optical waveguide design. As an example to use these solutions, the thermal stresses and the corresponding optical performance change induced by attaching a metal plate on the bottom of the substrate are analyzed. The results show that polarization shift and temperature sensitivity can be tuned in a wide range by varying the metal plate thickness and the curing temperature. My work demonstrates that the stress management is a promising method to control the performance of photonic devices.

About the Speaker. Dr. Huang is a TCAD (Technology Computer-Aided Design) engineer at Texas Instruments Incorporated. Prior to this position, he was a Lecturer and Research Associate at Princeton University. Dr. Huang's research interests focus on mechanics and materials of electronic, photonic and biomedical micro/nano systems. He has published 40 technical papers and 1 US patent in this area. Dr. Huang received his Ph.D. in Mechanical Engineering from Princeton University in 2001.