RENEW INFRASTRUCTURE BY SURFACE ENGINEERING: TOWARD ENERGY HARVESTING, INFRASTRUCTURE PROTECTION, AND SMART SYSTEMS

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Due to rapid urbanization and population expansion worldwide, addition of new construction in a built environment is not trivial while the existing infrastructure is constantly subjected to increasing demand. Any major disruption, caused by either natural or man-made actions, could have a strong impact on a large part of our nation. Therefore, protection of existing infrastructure, including building, roads, highways, bridges, etc., and enhancement of their performance and lifetime becomes of extreme importance from the viewpoint of security and economy. Inspired by human skin, emerging innovations and technologies are introduced to protect and rejuvenate our aging infrastructure by surface engineering technologies, smart sensing and control, and information management. Specifically, recent advances in energy efficient building, sun powered transportation system, and temperature regulated pavements will be introduced for improved durability and extended lifetime. Multifunctional materials and structures will be developed through physical and virtual experiments. The main approach is to design and develop bioinspired durable, smart skins to protect infrastructure with self-healing, temperature regulation, self-powered sensing and control. The fundamental understanding has been integrated into computer-aided design and manufacture for technology advancement and innovations. Finally, Dr. Yin will introduce his vision on energy in sustainable infrastructure and share some ongoing research at Columbia University.