The Hong Kong University of Science and Technology

Department of Mathematics

PhD THESIS EXAMINATION

Deep Generative Models for Topology Optimization

By

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ABSTRACT

Topology optimization constitutes a powerful computational approach for devising structures exhibiting optimized performance under designated constraints. In this thesis, we introduce a novel deep generative model, based on diffusion models, to address the minimum compliance problem.

The minimum compliance problem entails the identification of an optimal material distribution within a prescribed design domain, such that structural stiffness is maximized or, equivalently, compliance—a metric gauging flexibility—is minimized, subject to specific loading and boundary conditions.

Deep generative models represent a category of deep learning algorithms that have emerged as a propitious alternative to conventional topology optimization methodologies. These models, which encompass Variational Autoencoders (VAEs), Generative Adversarial Networks (GANs), and their variations, have demonstrated remarkable success in engendering high-quality designs through data-driven processes. Our research presents a successful framework based on the diffusion model which outperforms GAN-based models.

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The student's thesis is now being displayed on the reception counter in the General Administration Office (Room 3461).