New Development of NDT Technologies for Safety Assurance and Condition-based Maintenance of High-speed Train Running Parts

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For the Chinese railway, technology has been established to achieve the goal of safety priority and high-efficient with economic regard. This paper is thus a comprehensive overview of work trying to give a crosslink thinking among development of NDT techniques and the object of train safety assurance. Chinese experience of train-safety oriented NDT technologies and maintenance strategy, especially on high-speed train running parts, are employed to demonstrate these facts and to display what is the direction of this interdisciplinary field. In the very beginning of the paper, the development on railway transportation in China is placed. Following with typical failure types happened on running wheels, axles and bearings, the corresponding inspection methods are listed such as conventional manual NDT methods and innovated methods including advanced imaging algorithms such as FMC/PWI, acoustic diagnosis, infrared imaging, image-based MT, deep learning embedded classification and auto-alarming, etc. Besides, the paper also presents the latest automated inspection and measurement system applied on-site using Cloud inspection technology based on NDE4.0. As the most important part, content of Five-levels Comprehensive Inspection System shows how these method and equipment are deeply organized and complement to each other. This strategy ranges from on-board systems, mainline wayside and depot entrance line wayside systems, through light and heavy maintenance in the workshop, to highly data-integrated manage system. Finally, several still-open questions such as polygon wheels and innovating surface cracks of wheel and axle inspection methods are raised for further developing.