Wheel-Rail Profiles Matching Design Considering Railway Track Parameters

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Abstract: The profile of wheel/rail has great concern with the vehicle running safety, the wheel/rail wear and the rolling contact fatigue between wheel and rail, due to its severer impact on the dynamic behavior of both the railway vehicle/track, and the wheel/rail rolling contact status. However, recent studies in this respect are mainly explored in reverse methods, where track parameters are predetermined and invariable during the optimizing process. This paper attempts to propose a wheel-rail profiles matching design method considering multi-parameter, through optimizing wheel/rail profile under different rail cants and track gauges, based on the existed optimization technology for the normal gap of wheel/rail. The method presented in this paper can also, compared with the prior reverse methods, be called “forward solution method” in which the riding comfort, wheel unloading rate and wheel/rail contact stress of the speed-up railway passenger car are calculated by means of a vehicle-track coupling dynamic model, with the range of the rail cant varying from 1/20 to 1/40 and the rail gauge from 1 433 mm to 1 441 mm. These results show that the distribution status of the pairs of contact points can be obviously improved and the contact stress can be reduced significantly; a great influence is exposed by the rail cant and track gauge on the dynamic behavior of the high speed passenger car, and an optimal vehicle dynamics behavior are obtained with the optimized wheel/rail profile when the rail cant is 1/30 and the track gauge is 1 435 mm. This research can provide important references for the investigation of the wheel-rail profiles matching design method considering multi-parameter.

Key words: wheel profile, optimization, dynamic behavior, rail cant, track gauge

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