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Vibration of the Train/Track System with Two Types of Sleepers

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The conventional and reinforced railway track is composed of two infinite rails separated from the sleepers by visco-elastic pads. There are numerous assumptions leading to different simplifications in railway track modelling. Two-dimensional periodic model of the track consists of two parallel infinite Timoshenko beams (rails) coupled with the visco-elastic foundation (or equally spaced sleepers). Nowadays the interest of engineers is focused on the Y-shaped sleepers. The fundamental qualitative difference between the track with classic or Y sleepers is related to local longitudinal symmetric or antymetric features of railway track. The sleeper spacing influences the periodicity of elastic foundation coefficient, mass density (rotational inertia) and shear effective rigidity. The track with classical concrete sleepers is influenced stronger by rotational inertia and shear deflections than the track with Y sleepers. The increase of elastic wave velocity in track with Y sleepers and more uniform load distribution will be proved by the analysis and simulations. The analytical and numerical analysis allows us to evaluate the track properties in a range of moderate and high train speed. However, the correct approach is not simple, since the structure of the track interacts with wheels, wheelsets and vehicles, depending on the complexity of the analysis. We can notice the amplitude growth in selected velocity ranges.

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