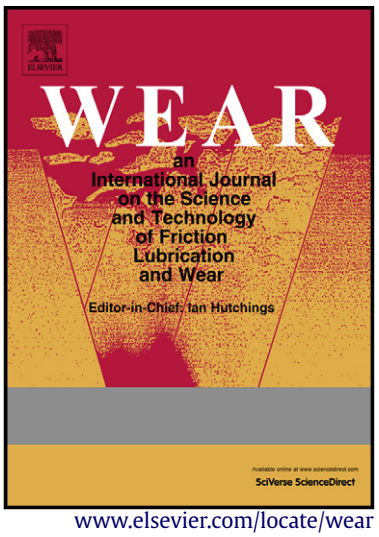


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# Effect of the wheel/rail contact angle and the direction of the saturated creep force on rail corrugation

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**Abstract**

The purpose of present work is to obtain a further understanding of rail corrugation on tight curved tracks. The stability of a wheelset-track system is studied using the finite element complex eigenvalue method. Based on the viewpoint of friction-coupling self-excited vibration causing rail corrugation, an elastic vibration model of the leading wheelset-track system is established. It is assumed that the creep forces at the inner and outer wheels of the leading wheelset are saturated when a vehicle negotiates a tight curved track, so the tangential forces are equal to the normal forces times the dynamic coefficient of friction. The simulation results demonstrate that the saturated creep force can induce self-excited vibration of the wheelset-track system, which is able to cause rail corrugation. The effects of the contact angle and the direction of the saturated creep force on the self-excited vibration of the leading wheelset-track system are studied. Parameter sensitivity analysis shows that the contact angle and the direction of the saturated creep force have significant effects on self-excited vibration of the leading wheelset-track system. Rail corrugation easily occurs when the contact angle is small. The saturated creep force in the lateral direction more easily produces rail corrugation than the saturated creep force in the longitudinal direction of the track does.

*Keywords:* Rail corrugation, Wear, Self-excited vibration, Contact angle, Traction angle



## 1. Introduction

Rail corrugation is one of the most serious problems in railway engineering, which causes fierce vibration of the structures of the railway vehicle and noise. It not only influences the comfort of passengers, but also reduces the service life of structural components. Furthermore, serious rail corrugation can lead to derailment accidents. Mild corrugation with small amplitude can be removed by grinding but rails with severe corrugation have to be replaced with new ones. The cost of grinding and replacement work is very high. Nowadays, completely eliminating or suppressing corrugation is still the best solution. In order to prevent the generation of rail

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