



Remedy of Squats

Root Causes Analysis

RESEARCH SCHOOL
INTEGRAL DESIGN OF STRUCTURES

Subject

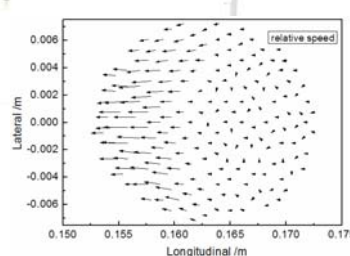
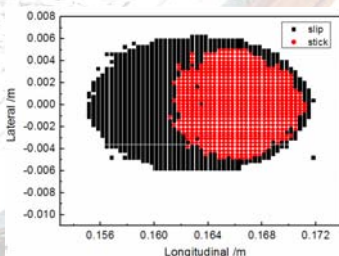
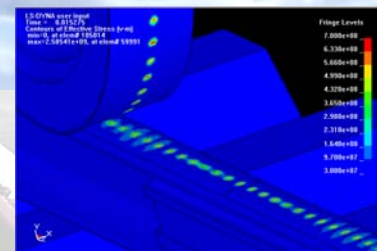
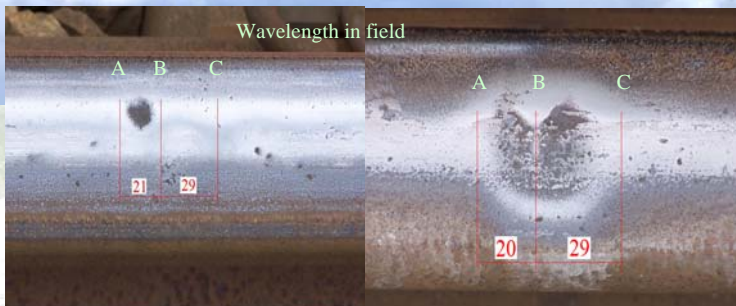
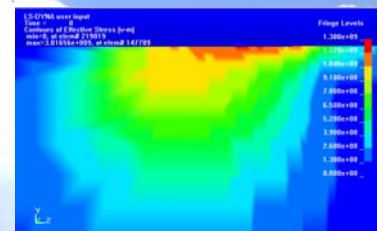
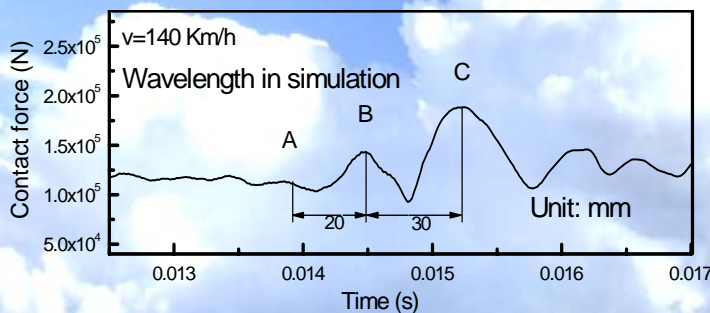
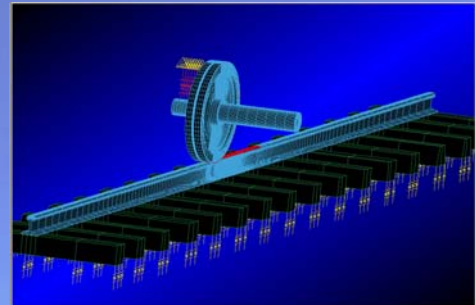
Squats, a type of rail rolling contact fatigue, lead to larger dynamic forces and shorter service lives of tracks and rolling stocks. The feasible remedies today increase maintenance cost and disturb railway service greatly. So more economic counter measures to squats based on fully understanding their root causes are necessary.

Goal

Identify the most important factors relative to squats initiation and growth. Propose possible counter measures to squats.

Expected Results

Identify 2-4 most important factors relative to squats initiation and growth. Propose some feasible economic measures to control the identified factors.



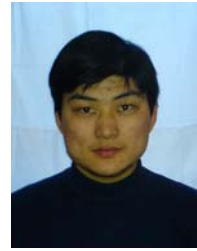
Remedy of Squats Root Causes Analysis

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Subject: Root Causes of Squats and Counter measures

Squat, a type of rail rolling contact fatigue (RCF) that tends to occur randomly in the running band of tangent track and shallow curves, is not essentially associated with any metallurgical fault. It can cause larger dynamic forces and shorter service lives of tracks and rolling stocks. If no remedy is offered in time, a squat might be a dangerous defect as multiple transverse rail fractures may occur, which can lead to catastrophic accidents. Nowadays, for squats the feasible remedies are grinding and welding, but they increase maintenance cost and disturb normal railway service greatly. So more economic counter measures to squats based on fully understanding their root causes are necessary.

Goals

Identify the most important factors that determine the occurrences of squats. Propose possible counter measures to delay and even prevent the occurrences of squats.

Research Question

Which factors determine the initiation of squats? What are the most important factors for squats growth? How to reduce the occurrences of squats effectively?

Strategy

Firstly, a correlation analysis over more than 300 locations is employed to identify the important characteristics of squats. Secondly, based on the conclusions from correlation analysis, a finite element (FE) model is created to make parameter variation analyses. With the FE model, dynamic wheel-rail contact states, which determine the occurrence of RCF directly, and the dynamic response of the system to surface defects can be investigated. Finally, guided by results from correlation analysis and FE analysis, monitoring tests at about 30 locations selected in the Dutch railway network are in progress, which can provide inputs for simulations and validate predictions.

Expected Results

Identify 2-4 most important factors relative to initiation and growth of squats. Propose some feasible economic measures to control the identified factors related to squats.

Preferred Partners Applications / Sponsors

Railway infrastructure managers/ProRail

Prime Publication / Prototyping

- [1] Zhao X., Li Z., Esveld C. and Dollevoet R.: The Effects of the Tangential Traction on Wheel-rail Dynamic Contact. *WSEAS Transactions on Applied and Theoretical Mechanics 2*: 52-59, 2007.
- [2] Zhao X., Li Z., and Dollevoet R.: An Investigation on Elastic-Plastic Rolling Contact over Rough Surfaces using a 3-D Dynamic Finite Element Model. Proceedings of International Joint Tribology Conference 2008, 20-22 Oct, 2008, Miami, USA.
- [3] Li Z., Zhao X., Esveld C., Dollevoet R. and Molodova M.: An Investigation into the Causes of Squats: Correlation Analysis and Numerical Modeling. *Wear 265*:1349-1355, 2008.
- [4] Li Z., Zhao X., Dollevoet R. and Molodova M.: Differential Wear and Plastic Deformation as a Cause of Squat at Track Local Stiffness Change Combined with Other Track Short Defects. *Vehicle System dynamics 46, Supplement 1*: 237-246, 2008.

Research Period

2006-2010

Research School Integral Design of Structures