TÉCNICO LISBOA

SEMINAR TALK

(in two parts / Free entry)

Room: SRDEM (Sala de Reuniões do DEM, Pav. Mecânica III, IST).
June 20th 2013, Thursday, 15:00-16:00 am

Title (Part 1 * 40min): *Selected Dynamical Phenomena in High-Speed Trains*

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There are many effects of dynamical behavior of rolling wheels. The first one phenomenon is connected with an unbalanced railway elastic wheel which vibration results in considerable variation of contact forces. The time behaviour of the travelling contact forces between the wheel sets and the rails influences smooth rolling. Similar effect gives non-uniform stiffness distribution around the wheel. In the case of interaction at high-speed an important part plays wave generation in periodic systems.

Dynamic overloading caused by the wave propagation in periodic subsystems [1] and self-excitation in some subsystems induce damages of wheels and rails forming in between secondary periodic effects like corrugation and polygonalisation [2], which heighten destruction of elements of the track and vehicles and, at the same time, spoil reliability, safety and passenger comfort. There are no simple antidotes to avoid all of the negative properties of above mentioned phenomena. But after investigation the problem of propagation and reflection of wave in periodic systems it is possible to use proper way of design the systems to choose the best solution, [3].

The lecture will be devoted to fundamental principles of wave propagation and such phenomena like passing bands and stopping bands, resonances and self-excitations. The primary periodic system in track structure is formed by periodic layout of rails fastening system (secondary periodic system is generated by corrugation). Similarly, cyclic spacing of wheels in the train, cyclic properties of wheels itself create primary periodic system of the train, while the poligonalisation and corrugation of wheels form the secondary periodic systems. In our presentation, a few innovative solutions of the track structure using new design of the sleepers and fastening systems experimentally evaluated in special section of Polish Railways [5] will be proposed.

Making use the experience in investigation of the special shape steel sleepers dynamics made for the ThyssenKrupp and using effects of the mistuning we offer a proposal for the track with special sleeper spacing with the simulation of train/track dynamical interaction.

1. R. Bogacz, K. Frischmuth: Abrazion and percussion effects in rail-wheel contact, Journal of Theoretical and Applied Mechanics, 50, 1, 2012, pp.119-130.
2. R. Bogacz, S. Dżuła: Dynamics and stability of a wheel-set in rolling contact motion on rails, in: Proceedings. of the ITTG Int. Symposium on Technological Innovation in Guided Transport, Lille, France, 1993, pp. 871–883
3. R. Bogacz, T. Krzyzynski and K. Popp, Application of Floquet's theorem to high-speed train/track dy-namics, DSC-vol.56/DE/vol.86, Advanced automotive technologies, ASME Congr 1995, pp. 55-61.
4. C. Lonsdale, R. Bogacz, M. Norton, Application of Pressure Poured Cast Wheel Technology for European Freight Service. Proc. of World Congress Railway Research. Lille,.2011,

5. R. Bogacz, W. Czyczuła, Mechanical analysis of track loading for high speed operation – track with PS-08 slipers and other track structures. Modern Technologies and Systems Increasing the Efficiency of Managing Railway Transport. Kraków 2010. pp. 39-55.

Title (Part 2 * 20min): *Dynamics of beam resting on nonlinear foundation: wavelet based Adomian solution*

Dr. Piotr Koziol, Koszalin University of Technology, Poland

Two theoretical models are analyzed: the Euler-Bernoulli beam and the Timoshenko beam. The beam resting on viscoelastic foundation characterized by nonlinear stiffness is subjected to a finite sum of moving loads representing train. The Adomian's decomposition combined with coiflet based approximation of integrals is applied to the considered problem. The maximal response of the system is analyzed and comparative study of results for both models is carried out. Some features of the developed approach, essential for accurate estimation of vibrations, are discussed. It is shown that in order to keep high accuracy of the nonlinear response approximation, the standard procedures based on the analysis of power spectrum in the transform domain are insufficient. Other criteria are needed for better representation of dynamic effects associated with nonlinear features, especially for complex models of moving load. The presented discussion is accompanied by numerical examples showing that effective parametrical analysis of dynamic nonlinear systems is possible by using the coiflet based approach.

All interested persons are invited to attend this seminar.

For further information, please contact:

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