Workshop on

# Integration of Finite Element and Multibody Dynamics Analyses for Accurate Failure Analyses of Railway Machine Elements at High Speeds

By

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Daywise schedule for the workshop :

**Feb 17, 2026 (Mon)**:

**9:00 - 11: 00 AM :** (i) Theory on effect of vehicle speed and track irregularities on exciting frequencies and *g* forces. (ii) Theoretical foundation for finite element analyses of eigenvalue problems (estimation of natural frequencies, critical buckling loads, etc.)

**11:15 - 11: 30 AM :** Tea break

**11:15 AM - 1:15 PM:** Equations solved, interpolations used, shape transformations considered, integration schemes used, matrix equations obtained, and computation size estimation in finite element analyses of eigen value problems

**1:15 - 2:45 PM :** Lunch break

**2:45 - 3:45 PM :** Use of part, property, assembly, step, interaction, mesh, job, and visualisation modules to solve for natural frequencies, critical buckling loads, associated vibration/buckling modes, etc. in commercial FEA software ABAQUS

**3:45 - 4:00 PM :** Tea break

**4:00 - 6:00 PM :** All workshop participants use ABAQUS to solve for natural frequencies and modes of vibration of simple systems

**Feb 18, 2026 (Tues)**:

**9:00 - 11: 00 AM :** Theoretical foundation for Finite element analyses of dynamics problems

**11:15 - 11: 30 AM :** Tea break

**11:15 AM - 1:15 PM:** Equations solved, integration schemes used, matrix equations obtained, and computation time estimation in finite element analyses of dynamics problems

**1:15 - 2:45 PM :** Lunch break

**2:45 - 3:45 PM :** Use of ABAQUS to study the effect of vehicle speed on railway vehicle dynamics, especially the rail-wheel contact forces and coach, bogie, axle accelerations

**3:45 - 4:00 PM :** Tea break

**4:00 - 6:00 PM :** All workshop participants use ABAQUS to solve for rail-wheel contact forces and coach, bogie, axle accelerations for given track irregularies using rigid body dynamics

**Feb 19, 2026 (Wed)**:

**9:00 - 11: 00 AM :** Study of earlier works on effect of dynamics of railway machine elements, e.g. wheelsets, coil springs, bogie frame etc. on failure of machine elements

**11:15 - 11: 30 AM :** Tea break

**11:15 AM - 1:15 PM:** Estimation of mode shapes, natural frequencies for railway machine elements using ABAQUS

**1:15 - 2:45 PM :** Lunch break

**2:45 - 3:45 PM :** All workshop participants use ABAQUS to solve for mode shapes of railway machine elements using ABAQUS. These will be used as input to SIMPACK at a later stage.

**3:45 - 4:00 PM :** Tea break

**4:00 - 6:00 PM :** Participants complete all pending works in ABAQUS

**Feb 20, 2026 (Thur)**:

**9:00 - 11: 00 AM :** Setting up of a railway vehicle dynamics problem in SIMPACK

**11:15 - 11: 30 AM :** Tea break

**11:15 AM - 1:15 PM:** Setting up of a railway vehicle dynamics problem in SIMPACK

**1:15 - 2:45 PM :** Lunch break

**2:45 - 3:45 PM :** Importing information of flexible primary spring from ABAQUS into simpack

**3:45 - 4:00 PM :** Tea break

**4:00 - 6:00 PM :** All workshop participants use SIMPACK to setup the problem and import the spring modes of vibrations from ABAQUS

**Feb 21, 2025 (Fri)**:

**9:00 - 11: 00 AM :** Study the effect of track irregularities and train speed on dynamics of primary coil spring in SIMPACK

**11:15 - 11: 30 AM :** Tea break

**11:15 AM - 1:15 PM:** Estimate the stresses in the coil spring with variation in track irregularities and train speed

**1:15 - 2:45 PM :** Lunch break

**2:45 - 3:45 PM :** All workshop participants use ABAQUS and SIMPACK to solve for stresses in coil springs for varying track irregularities and train speeds

**3:45 - 4:00 PM :** Tea break

**4:00 - 6:00 PM :** All workshop participants use ABAQUS and SIMPACK to solve for stresses in coil springs for varying track irregularities and train speeds

**Feb 21, 2026 (Sat)**:

**9:00 - 11: 00 AM :** Exam on content covered

**11:15 - 11: 30 AM :** Tea Break

**11:30 AM - 12:00 PM:** Distribution of certificates, photographs, and closure of workshop