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C. Ludwig

ANALYTICAL AND EXPERIMENTAL MODAL ANALYSIS OF A LUGE CONSIDERING RESILIENCE AND NONLINEARITY OF COMPLETE SYSTEM ATHLETE AND LUGE

Today sled development includes a lot of engineering sciences, for example fluid mechanics, tribology and dynamics. New changeable conditions of the artificial tracks due to unsteady weather, faster tracks like Vancouver and external conditions for example revision of rules increase the requirements concerning sleds undercarriage kinematics.

State of the art chassis suspension is developed empirically. The diploma thesis: „Analytische und experimentelle Modalanalyse eines Skeletonschlittens unter Berücksichtigung realer Erregerspektren“ [1] is concerned with skeleton-sleds undercarriage dynamics.

Goals of this study are the identification dynamic vibrations effects driving performance. Sled vibrations are measured during the run. After this, power spectrums and frequency response functions are computed. Natural modes (Figure 1) are computed with a FEM-model. The simulation includes pre-loaded runners and a simplified athlete model. It was finally drawn comparison of measurement and computation. The results show a shifting of characteristic frequencies as a result of nonlinearity. That is because of different radial accelerations.

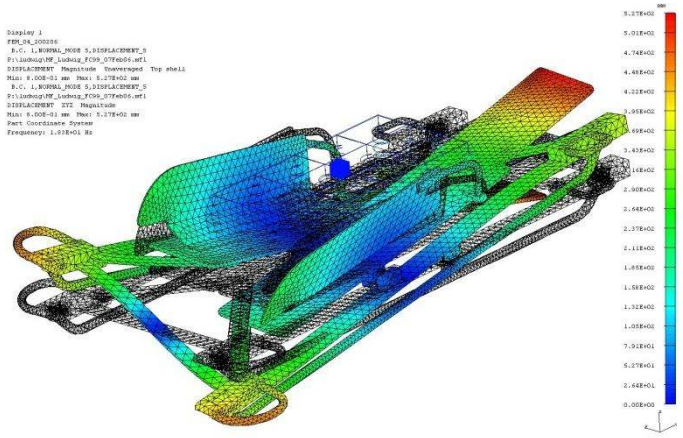

Figure 1: Skeleton sled normal mode

Similar research into luge dynamic should help to develop faster luges, now. A luge test run and the computation of power spectrums, frequency response functions pictures the actual condition. The luge with acceleration sensors is shown in Figure 2.

Figure 2: Luge with acceleration sensors

In a Luge-athlete-system the athlete accounts for approximately 75 % of the total mass. Both, mass and resilience are important for the system's dynamic. We will advance luge undercarriage kinematics by the use of resilient multi-body system considering luge-athlete-system in the near future. Up to date simulation sub models will be created for glass-fiber composite seat shell, resilient joints containing virtual pivots and the athlete being in contact with the luge.

References:

[1] „Analytische und experimentelle Modalanalyse eines Skeletonschlittens unter Berücksichtigung realer Erregerspektren“

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