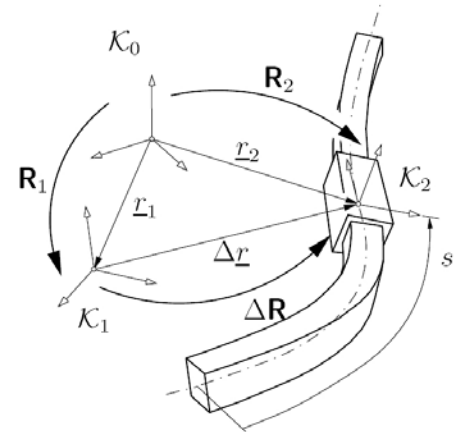


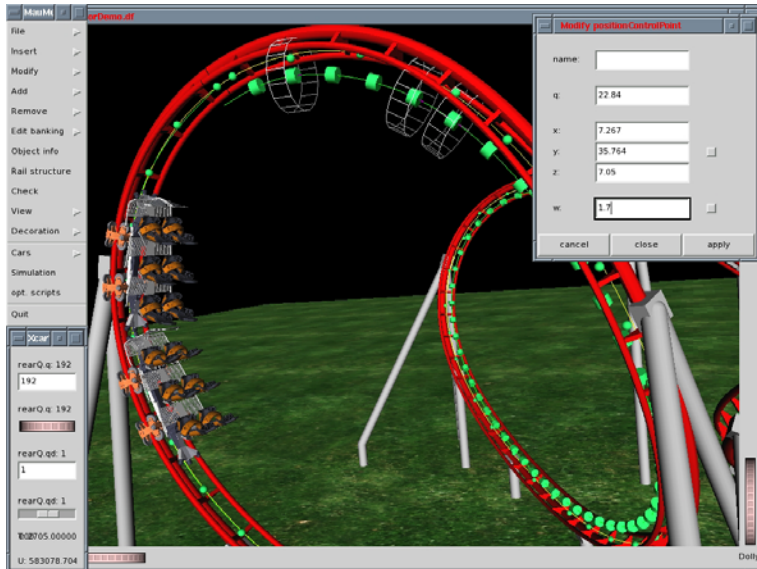
Virtual Reality design of roller coaster tracks



Modern roller coaster rides are complex constructions which display highly nonlinear dynamic properties and challenging problems due to friction losses. Nevertheless, high reliability, comfort, and especially safety are expected from these attractions. In this project, the multibody environment XTRAC™ for design of roller coaster tracks is developed in cooperation with the roller coaster manufacturer Maurer Söhne. The design environment involves a globally optimized quintic spline description of the track as well as local editing functions for its manipulation. The spline description is adapted into a generalized curve joint that can be used kinematically and dynamically as an elementary joint, i.e., as an element of kinematical loops as well as a building block for the equations of motion in minimal form including the track coordinates. Using this approach, different vehicle models and new roller coaster features can be



incorporated into the design environment easily, and the design effort is significantly reduced compared with conventional approaches using several simulation tools and CAD-environments.



The developed roller-coaster environment considers the most important design criteria such as minimal track curvature, avoidance of collisions between track, roller coaster cars, passengers, and environment, allowed accelerations, wheel loads on rails and support structure or minimal velocities, as well as financial issues. On top of the mechanical model built with the multibody modeling library MOBILE, XTRAC™ provides a graphical user interface based on the visualization library Open Inventor/Coin3D. The user interface allows one to modify the trajectory by picking and dragging control points of the spline which represents the center line of the track. During the motion, the graphic representation of the rail is updated in real time. Analogously, the banking angle can be modified by turning virtual knobs distributed along the track.

A screen shot of the graphical user interface with spatial draggers is displayed to the left.

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